APPENDIX F

INTERFACE CONTROL DOCUMENT

FOR

INTEGRATED RECEIVER − SUBSYSTEM CONTROLLER/USS ADPE STATUS AND CONTROL 1553B INTERFACE

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SECTION F1
INTRODUCTION

F1.1 PURPOSE

The purpose of this document is to provide a detailed definition of the interface between the Integrated Receiver (IR) and the USS Subsystem Controller (SSC)/USS ADPE.

F1.2 SCOPE

This Interface Control Document (ICD) defines and controls the applications functions, communications protocol, messages, message formats, and the electrical and mechanical characteristics of the interface between the IR and the USS SSC/ADPE.

SECTION F2
APPLICABLE DOCUMENTS

F2.1 GENERAL

The following documents, are part of this specification to the extent cited herein.

F2.2 SPECIFICATIONS

STGT - HE - 06 - 01, 9/90	HW/SW Interface Document

F2.3 STANDARDS

MIL - STD - 1553B 9/86 through Notice 2	Aircraft Internal Time Division Command/Response Multiplex Data Bus

SECTION F3
SYSTEM DESCRIPTIONS

F3.1 GENERAL

This section provides background information on the functions of the IR and its support role in user services.

F3.2 INTEGRATED RECEIVER (IR) DESCRIPTION

F3.2.1 FUNCTIONAL OVERVIEW

The IR, processes all S - band Single Access (SSA) return data, all Multiple Access (MA) return data, and all K - band Single Access (KSA) Low Data Rate return data, for the User Services Subsystem (USS). The essential functions of this unit are:

a. Carrier acquisition and tracking.

b. PN code acquisition and tracking.

c. Symbol recovery and synchronization.

d. Deinterleaving and decoding of return service data.

e. Data recovery and formatting, including ambiguity resolution.

f. Generation of range and Doppler tracking data.

g. Generation of performance and status data, including self - test and fault isolation information.

h. To provide signals to aid KSA Autotrack and MA Beamforming.

Figure F3 - 1 shows the IR Functional Block Diagram

F3.2.2 (NOT USED)

F3.2.3 LRU DESCRIPTIONS

a. MODEM CONTROL PROCESSOR (MCP) LRU

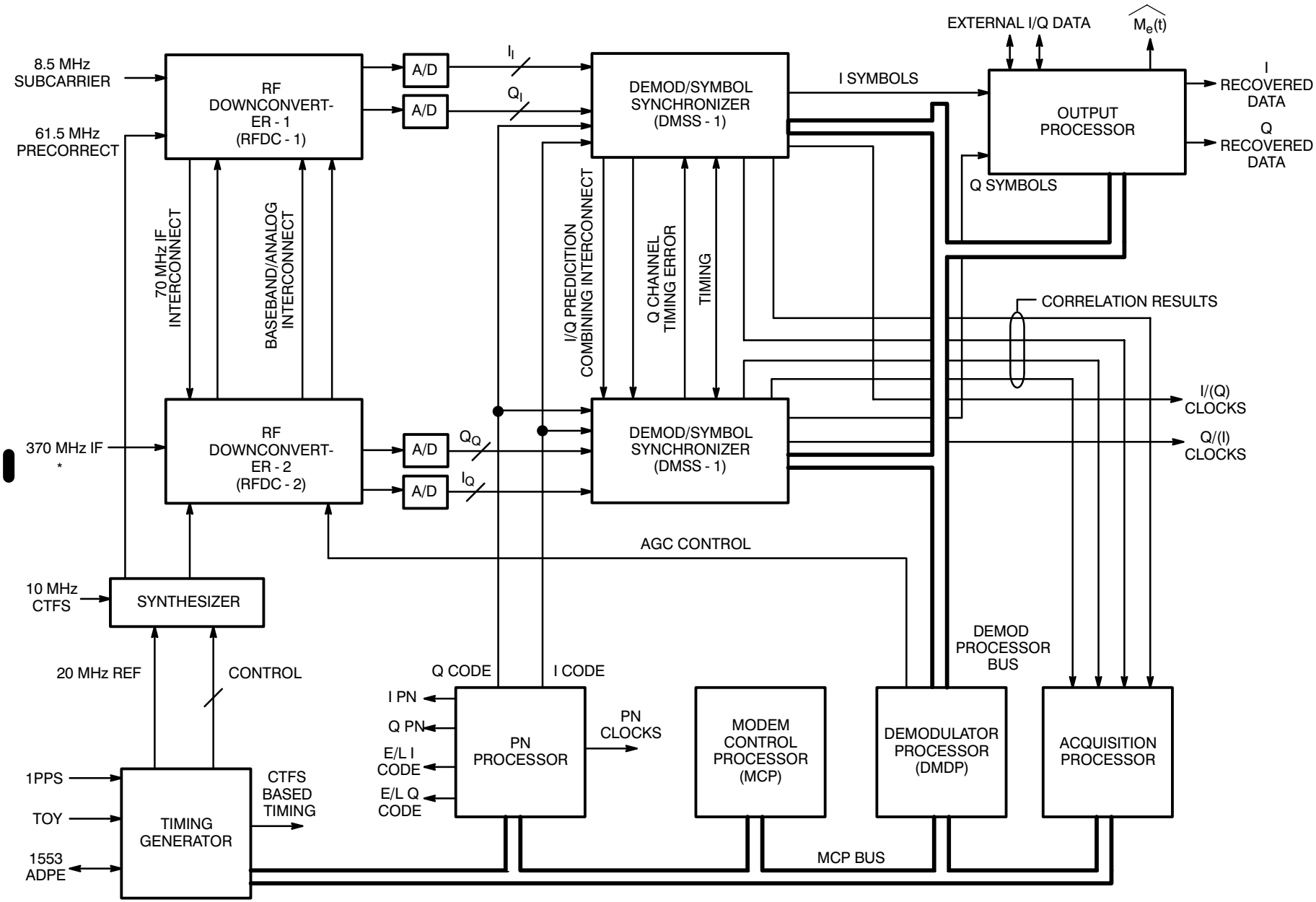
The Modem Control Processor is a 25 MHz 68030 processor based VME bus controller with 68882 floating point co - processor, 1 MB zero wait state static RAM, and four EPROM sockets.

b. ACQUISITION PROCESSOR (ACQ) LRU

The Acquisition Processor:

1. Communicates with the MCP over the VME bus

2. Provides coherent combine of formatted correlator data on command



*High Rate Downconverter (HRDC not shown)

Figure F3–1. IR Module Diagram

3. Provides coherent channel combine of formatted correlator data
4. Provides non - coherent combine
5. Provide non - coherent channel combine
6. Finds and saves the peak magnitude and index of the combined correlator data and supplies to the MCP

c. PN CODE PROCESSOR (PNP) LRU

The PN Processor:

1. Generates PN codes compatible with TDRSS services
2. Generates two I and Q code strings, one for acquisition and one for track
3. Contains an acquisition code generator for step search control and acquisition accumulator control
4. Contains a track code generator for early, on time, and late replica PN code strings

d. TIMING GENERATOR (TIME) LRU

The Timing Generator:

1. Provides Time of year data (seconds, minutes, hours, and days) from the input serial IRIG - B data
2. Provides a microprocessor controlled 1553 interface
3. Provides timing and epoch interrupts from the 1 PPS, Epoch, and 50 MHz signals and accept masking of any or all of these interrupts
4. Provides an epoch count
5. Provides two Numerically Controlled Oscillators adjustable by microprocessor control
6. Provides Control/Status communication between the RF modules and the MCP
7. Provides an analog voltage measurement of various power sources upon microprocessor command

e. DEMOD PROCESSOR (DMDP) LRU

The DMDP consists of a Digital Processor (DSP), an FFT Controller (FFTC), and the associated hardware to perform the following functions under firmware direction:

1. Communicate with the Modem Control Processor (MCP)
2. Control signal tracking loops as required by the application. This involves using a Fast Fourier Transform (FFT) process to acquire the carrier, and second - and third - order

digital phase - locked loops to track it. Control information is sent to, and status and data received from, the Demon Symbol Synchronizer (DMSS).

3. Provide non - coherent Automatic Gain Control (AGC) and dc - bias compensation to maintain proper signal input levels from the RF section of the unit to the digital processing section

4. Send control information to the Output Processor, to direct the decoding and autotrack functions

f. OUTPUT PROCESSOR (OUTP) LRU

The Output Processor:

1. Receives 5 - bit differential I and Q symbol data and their clocks from the DMSSs

2. Provides SSA combining and synchronization of the I and Q symbol data with input base-band demodulated I and Q signals from a second co - located Integrated Receiver (IR)

3. Provides deinterleaving and decovering of interleaved I and Q symbol data upon control from DMDP

4. Provides Viterbi decoding of I and Q symbol data upon control from the DMDP

5. Provides Shuttle decoding of I symbol data upon control from the DMDP

6. Differentially decodes NRZ - M and NRZ - S formatted I and Q symbol data to NRZ - L formatted data

7. Provides the KSA Autotrack envelope

8. Differentially drives input PNP timing, lock, and status signals

g. DEMOD/SYMBOL SYNCHRONIZER (DMSS) LRU

The IR contains two identical DMSS modules, one for I - channel processing and one for Q - channel. Each DMSS:

1. Communicates with the DMDP over the TMS BUS

2. Filters the I and Q data from the RF modules

3. Provides two 2 - bit variable length correlators

4. Provides symbol/data recovery

5. Provides an 8.5 $\pm$ 0.5 MHz carrier L.O.

h. SYNTHESIZER (SYNTH) LRU

The SYNTH LRU uses the externally provided 10 MHz frequency reference signal to provide all of the clocks required by the modules of the IR.

i. RF DOWNCONVERTER NO. 1 (RFDC1) LRU

RFDC1 directly accepts a 70 MHz IF input from RFDC2 or it accepts an 8.5 MHz subcarrier and converts it to 70 MHz. The leveled 70 MHz IF is then quadrature downconverted to produce baseband I and Q. These are then lowpass filtered and quantized.

All quantizer outputs are then sent to the DMSS.

j. RF DOWNCONVERTER NO. 2 (RFDC2) LRU

The RFDC2 accepts a 370 MHz IF input and downconverts it to 70 MHz. The leveled 70 MHz IF is then quadrature downconverted to produce baseband I and Q. These are then lowpass filtered and quantized. The quantizer outputs are then sent to the DMSS.

k. HIGH RATE DOWNCONVERTER (HRDC) LRU

The HRDC accepts a 370 MHz IF input for KSHR Mode 1 and certain other KSAR high data rate services. When selected by the IR, the HRDC performs Costas loop phase detection. The detected analog phase error signal is sent to RFDC2 for A/D conversion and subsequent routing to DMSS2. The I and Q arms of the phase detector contain baseband signals, either of which can be selected for further signal processing. For KSHR Mode 1, the Q baseband signal contains the subcarrier with Channel 1 and Channel 2 data and is routed to RFDC1. For DG1 Mode 3, the I baseband signal contains a PN spread signal that can be routed to RFDC2. Whether the IR routes the input 370 MHz to RFDC2 or to HRDC for high data rate KSAR depends on the mix of I and Q data rates, and on the service mode. The ADPE does not explicitly make the selection.

l. POWER SUPPLY NO. 1 (PS1)

This power supply supplies $\pm$15 volts, +5 volts for logic, and separate +5 volts for RF to the following modules:

RFDC1	ACQP
RFDC2	DMDP
SYNTH	DMSS
OUTP	MCP
TIME	PNP

- Regulated outputs: ($\pm$5% adjustable)
  - — 5 volts (main) - 75 amp, max (+5)
  - — 15 volts - 7.2 amp, max (2 outputs) ($\pm$15)
  - — 5 volts (aux) - 7.5 amp, max (2 outputs) (+5 RF)
- 475 watts total output power, max

m. POWER SUPPLY NO. 2 (PS2)

This power supply supplies - 5.2, $\pm$12 volt power to the following modules.

DMSS	TIME
RFDC1	OUTP
RFDC2	SYNTH

- Regulated outputs: ($\pm$5% adjustable)
  - — 5 volts (main) - 30 amp, max (- 5.2)
  - — 12 volts no. 1 - 5 amp, max (+12)
  - — 12 volts no. 2 - 6 amp, max (- 12)
- 220 watts total output power, max.

F3.2.4 CRITICAL PERFORMANCE STATUS DESCRIPTION

IR Performance Reports

a. E_b / N_o - The E_b/N_o measurement is based on the signal magnitude and the noise magnitude in the DEMOD ASIC. The possible range of values is - 45.0 dB to +65.0 dB with a resolution of 0.1 dB. The E_b/N_o values will be collected every 10ms and averaged over the last one second interval.

b. Symbol Error Count - The number of bit errors that were detected in the last one second interval. The measurement is determined by the decoder chip.

c. Range - The range measurement is based on the total round trip delay from the MDP to the IR. The measurement will have a resolution of 1 ns.

d. Integrated Doppler Frequency - The raw IF frequency measurement relative to the nominal input IF. This measurement will include forward doppler correction for coherent modes. The measurement will be the doppler over the last 1 second interval with a resolution of 0.001 Hz. The doppler measurement will be zeroed initially upon phase lock and at the effective time of a Zero Doppler Count Command.

e. Time Transfer Measurements - The first and second PN epoch measurements relative to the 1 PPS mark. Each measurement is an elapsed time from the 1 second mark with a resolution of 100ns. These measurements are always from the 1PPS preceding the report time.

f. AGC Status - An indication of the operating level of the Non - Coherent AGC at the RFDCs and the Data AGC at the DEMOD ASICs. When the circuit is operating outside of the AGC range, an over/under limit indication will occur.

g. Acquisition Time - The time to acquire from the Start Acquisition command to Phase Lock/ Symbol Lock/Decoder Lock (depending on mode of service). The measurement has a resolution of 10ms.

F3.2.5 BUILT–IN TEST (BIT)OVERVIEW

a. Confidence BIT - LRUs Tested: MCP, ACQ, PNP, TIME, DMDP, DMSS1, DMSS2, PWR SUPPLIES, TEMP. This function consists of the following test groups:

1. Test CPU
2. Test VME
3. Test Environment
4. Test Demod ASIC
5. Test RAM
6. Test DMDP
7. Test 1553
8. Test Indicators

b. Online BIT - LRUs Tested: MCP, TIME, DMDP, PWR SUPPLIES, TEMP, HRDC (if present). This function consists of the following monitor groups:

1. Monitor Synth Lock
2. Monitor 1PPS
3. Monitor Environment
4. Monitor Time
5. Monitor TMS Status
6. Monitor CPU Exception
7. Monitor ALC Levels

c. Extended BIT Tests - This function consists of the following test groups:

1. Test MCP

LRUs Tested - MCP, TIME

Pass/Fail Criteria - The MCP test will pass if each MCP subtest passes. If any of the MCP subtests fail, the MCP test will also fail.

This MCP test subprocess consists of the following subtests:

68030 Test
PIT Test

MCP Subtest Descriptions:

68030 Test - This subtest verifies operation of the 68030 MCP processor. The 68030 functions tested include the following:

Internal register operation
Addressing modes
Instruction set operation
Exception processing

This subtest will fail if any of the tested functions are not operating as expected.

PIT Test - This subtest verifies operation of the two MCP PITS. This subtest tests the PIT's registers, timers, and interrupts. The registers are tested by writing and reading a test word to/from each register and verifying that the word read from the register is the same as the word written to the register. The two PIT timers are tested by comparing their measurand of a short period of time. This subtest will fail if a register data write/read is inconsistent, or if the PIT timers do not measure a period of time within +/- 5 percent of each other, or if the PIT interrupts do not occur.

2. Test VME

LRUs Tested - PNP, ACQR, DMDP

Pass/Fail Criteria: The VME test will pass if each VME LRU can be written to and/or read from without error. If a write/read error is detected with any of the VME LRUs, this test will fail.

This VME test subprocess verifies operation of the VME data transfer bus. A test data word is written to and/or read from each of the VME slave LRUs, as listed under "LRU's Tested". If a bus exception occurs during LRU access, this test will fail. On those LRUs that have a write/read capability, a test word written to the LRU is compared to the test word read from the LRU. If the test data words do not compare, this VME bus test will fail.

3. Test Time

   LRUs Tested - TIME

   Pass/Fail Criteria: The TIME test will pass if each of its four timing interrupts (1, 10, 100, and 1000 PPS) occur within a reasonable tolerance, and the 5V reference is within a reasonable tolerance. Otherwise, if any of these measurements are out of tolerance, this test will fail. Also, if resynchronization is in progress and no external 1PPS signal is present this test will fail due to lack of time interrupts.

   This test verifies the following functions of the TIME LRU:

   Timing interrupts
   A/D converter

   The intervals of each of the TIME LRU's timing interrupts are measured by a PIT counter and verifier to be within a reasonable tolerance of the nominal time period.

   The reference 6.2 input to the TIME LRU's A/D converter is converted to a digital representation and verified to be within a reasonable tolerance of nominal 6.2V.

4. TEST DMDP

   LRUs Tested - DMDP

   Pass/Fail Criteria: The DMDP test will pass if each DMDP subtest passes. If any of the DMDP subtests fail, the DMDP test will also fail.

   This DMDP test subprocess consists of the following subtests:

   DMDP SELFTEST
   DPRAM TEST

   DMDP Subtest Descriptions:

   DMDP SELFTEST

   The MCP initiates this test by sending the DMDP TMS processor the RESET_TMS command. The DMDP TMS processor verifies operation of itself, FFT device, and operation of the DPRAM from the DMDP.

   This subtest will fail if any of the tested functions are not operating as expected as indicated by the test results.

   DMDP RAM TEST

The MCP initiates this test by sending the DMDP TMS program the DPRAM_BIT command.

This subtest verifies operation of the DMDP dual ported RAM (DPRAM). The DPRAM is tested by four write/read data patterns: 5's, A's, address, and inverse address. The 5's and inverse address patterns are written by the MCP and read/validated by the TMS. The A's address pattern is written by the TMS and read/validated by the MCP. This subtest will fail if any test data read from the DPRAM does not correspond to the test data written to the DPRAM.

5. TEST DEMOD ASIC

   LRUs Tested - DMSS1, DMSS2

   Pass/Fail Criteria: The demodulator ASIC test will pass if each signature subtest produces its expected output. Otherwise, any unexpected signature test will cause this test to fail.

   The MCP controls the DMDP by sending the appropriate ASIC command.

   After all of the signature tests have been completed, the TMS returns the ASIC test results indicating test completion to the MCP.

6. TEST SIGNAL LEVELS

   LRUs Tested - Time, Synth, DMDP, RFDC1, RFDC2, DMSS1, DMSS2

   Pass/Fail Criteria: The signal levels test will pass if the new DC bias has not significantly changed from the previous DC bias. Otherwise, the test will fail.

   The signal levels test verifies that a DC bias can be compensated for, and that the RMS I and Q signal levels are within +/- 5% of each other, when measuring a test signal. This test verifies the signal levels through five data paths in the IR.

   The MCP selects a 70 MHz test signal and commands the TMS processor to perform a DC bias procedure. The MCP then verifies that the new bias values have not varied more than a reasonable amount from their previous values.

   The MCP then configures the TMS processor for a carrier NCO offset of 10,000 Hz from its 8.5 MHz frequency, with a sample rate of 5 Hz bin width. The MCP commands the TMS processor to acquire and after acquisition is achieved, reads the RMS magnitude of the I and Q signals from the TMS processor. The I and Q signal magnitudes are compared by the MCP to determine test result as defined above.

7. TEST PNP

   LRUs Tested - PNP, TIME

   Pass/Fail Criteria: This PNP test will pass if epoch interrupts occur when expected within a reasonable time interval, and if epoch PN codes are as expected. Otherwise, if any

sampled PN codes are not as expected, or if an epoch interrupt does not occur or occurs outside of a reasonable time interval, this test will fail.

This PNP test configures the PNP LRU to generate PN codes, and cause an interrupt at epoch occurrence. The PN codes at the epoch are sampled to verify their values. Acquisition and Track epoch interrupts are timed to verify that they occur within a reasonable time interval.

8. TEST CORRELATOR TAP

LRUs Tested - DMDP, ACQU, PNP, DMSS1, DMSS2

Pass/Fail Criteria: This correlator tap test will pass if each of the four selected taps yield expected peak indices and bin magnitudes, and if a peak detect interrupt occurs within a reasonable period of time. Unexpected peak indices, bin magnitudes or peak detect interrupts will cause this test to fail.

The PNP LRU is configured with values for coherent and non - coherent combines, and NCO parameters. The ACQR LRU is configured with an offset, correlator MUX set to select a constant '1', and the following correlator lengths.

Correlator Length (A)	Corresponding Taps and Bin Magnitudes
00h	4
55h	344
AAh	684
FFh	1024

The correlation is started, the peak detect interrupt timed, the peak index and bin magnitudes read and verified to determine test results as defined above.

SECTION F4
INTERFACE CONFIGURATION AND CONTROL

Figure F4 - 1 illustrates the configuration of the IR - SSC/ADPE interface and the interactions that are defined. The IR and the USS ADPE interact directly at the user levels (interactions 1 through 3). The SSC provides the interfacing medium for the transport service levels (interactions 4 through 13). Requirements allocations for each of the 14 interactions are shown in Table F4 - 1.

TABLE F4—1. REQUIREMENTS ALLOCATION

Interaction Number	Unit		
	IR	SSC	ADPE
1	X		X
2	X		X
3	X		X
4	X	X	
5		X	X
6	X	X	
7	X	X	
8 - 13		X	X
14		X	X

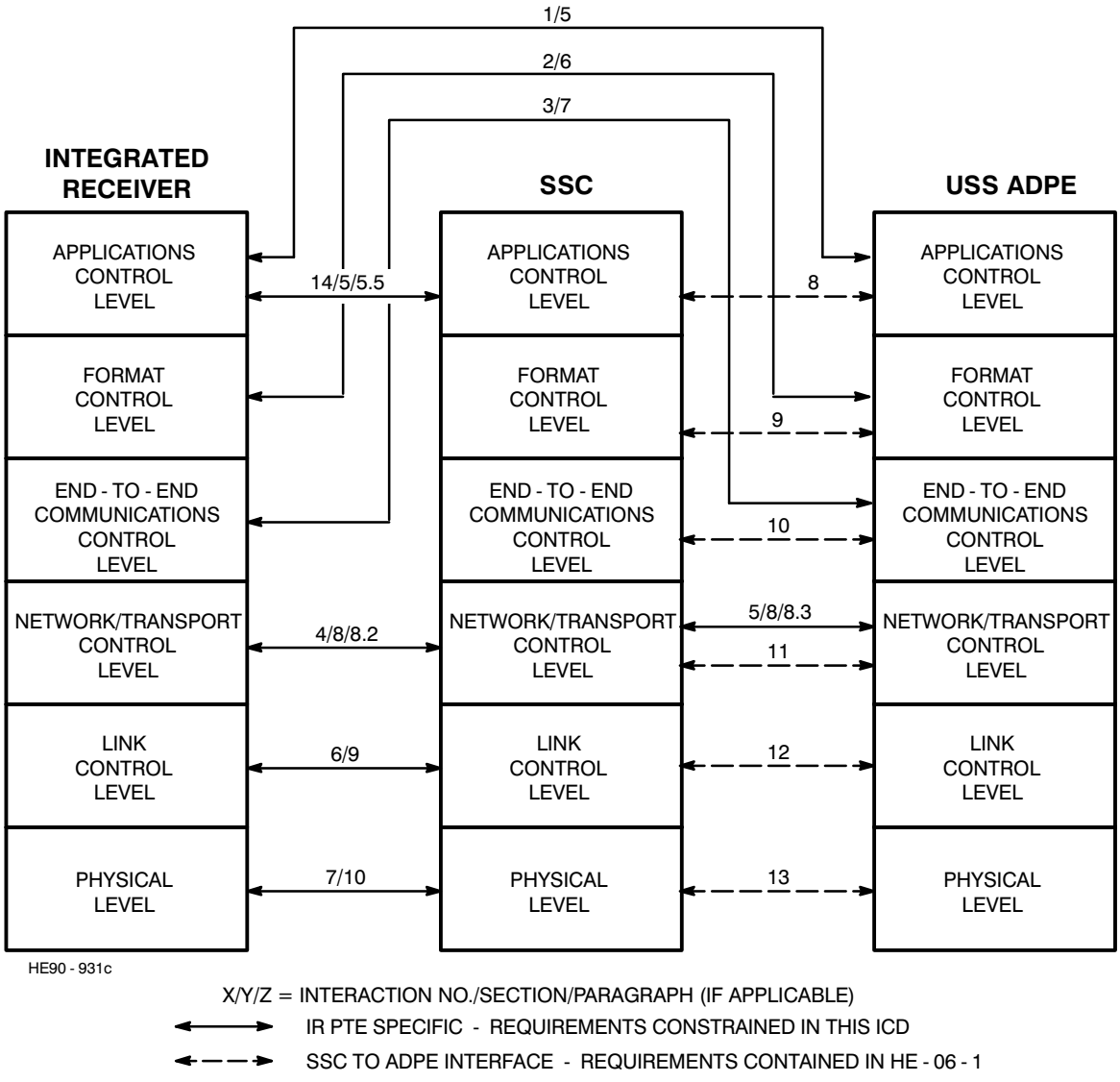


Figure F4—1. IR — SSC/ADPE Interface

SECTION F5
APPLICATIONS CONTROL LEVEL

F5.1 GENERAL

This section describes the IR - SSC/ADPE interface at the Applications Control Level (interaction 1 of Figure F4 - 1).

F5.2 IR COMMANDING

F5.2.1 TIME DEFINITIONS

Effective Time shall be defined as the exact 1pps time that command execution shall initiate for synchronous commands.

Execution Time shall be defined as the maximum time that a command takes to complete its function.

Setup Time shall be defined as the maximum time required to prepare for execution of a synchronous commands.

Initiation Time shall be defined as the Effective Time for synchronous commands, and the actual implementation time for asynchronous commands.

F5.2.2 SYNCHRONOUS COMMANDS

Synchronous commands shall be defined as commands which contain an effective time, so that command execution may be time synchronized with other units.

Table F5 - 1 shows the setup and execution times for each of the commands.

The effective time shall take place on the 1 pps of the time specified in the time field of command. The execution time shall be measured from the effective time. For commands that are to be completed and latched at the 1 pps, execution time is specified as zero. Setup time is defined as 1 second for all synchronous commands. Figure F5 - 1 shows a pictorial representation of these times.

The unit is not required to execute more than one synchronous command per effective time.

For synchronous commands that involve frequency control, the ADPE will not activate more than one altered profile command at a time. For example, commands to break lock will not be sent during a frequency sweep. Control commands are active during the time between the EFFECTIVE TIME and EFFECTIVE TIME + DURATION.

F5.2.3 ASYNCHRONOUS COMMANDS

Asynchronous commands are defined as commands that do not contain an effective time. They are executed as soon as possible from time of receipt, such that the maximum execution time allowed for completion of the command does not exceed the execution time specified in Table F5 - 1. The execution time for an asynchronous command shall be specified from time of receipt at the unit.

TABLE F5—1. SETUP AND EXECUTION TIMES

Command	Sync / Async	IR	
		Setup Time (in seconds)	Execution Time (in seconds)
Set State	A	N/A	1
Common Config	A	N/A	1
Specific Config IR	A	N/A	1
Start Acquisition - (Note 2)	A	N/A	1
Zero Doppler Count	S	1	0
Expand Freq. Search	A	N/A	1
Burn Alert	A	N/A	var
Start Forward Model	S	1	0
Forward Freq Sweep	S	1	120
Forward Doppler Compensation Control	S	1	var
Cold Start	S	1	0
Forward Break Lock	S	1	var
Download - (Note 1)			
Ephemeris Data - (Note 1)			

NOTES:

1. Timing definitions are specified in paragraph 5.4.

2. The Execution Time is three seconds for Start Acquisition commands received while the IR state is ACQUISITION, REACQUISITION or TRACK.

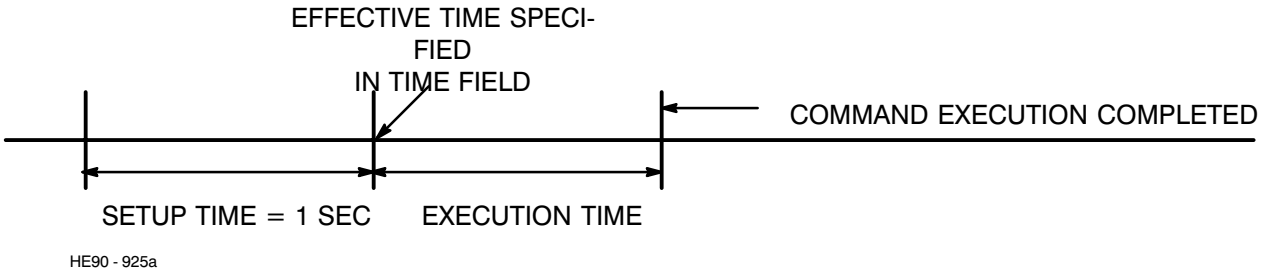


Figure F5—1. Time Definitions

The **maximum command rate** (maximum commands per second) for any given asynchronous command is defined as 1 / Execution Time. Should this rate be exceeded, the unit shall not malfunction or lock - up. The unit may overwrite the previous command of the same type.

No more than 4 asynchronous commands may be sent to the unit in any 1 second period.

F5.2.4 IR COMMAND AND OPERATING STATES

F5.2.4.1 General

The IR operating states consist of seven major states, as described in the following paragraphs. The status of the forward model execution is also described.

F5.2.4.2 Operating State Descriptions

Commands shall be accepted or executed in the states indicated in Table F5 - 2a. Table F5 - 2c shows the IR Return State Transition Table (STT) in terms of events and actions. A simplified state transition diagram is shown in Figure F5 - 2.

Confidence Test in Progress - This state shall be entered upon power - up or reset. During this state, the IR will be executing its confidence test, and will not respond over the 1553b interface. This state will complete in less than 10 seconds. During this state, the TEST LED on the front panel will be set. If the confidence test fails, the FAULT LED on the front panel will be set.

Extended BIT - This state shall be entered by an Extended BIT command from either front panel or 1553b, and shall exit either upon completion of the BIT or by termination of BIT by either front panel or 1553b command.

Standby - This state shall be entered by completion of the confidence test, or by command via the 1553b interface. This state indicates that the IR is ready to receive a SPECIFIC CONFIGURATION COMMAND. Upon receipt of a SPECIFIC CONFIGURATION COMMAND, the IR shall start configuration of the unit. Upon receipt of an Extended BIT command, the IR shall begin extended BIT.

Configuration In Progress - This state shall indicate that the IR is dedicated to configuration of the unit. No other signal acquisition or tracking will be done while in this state. The IR is configured as per the specific (and common if applicable) configuration commands received via the 1553b interface. Upon completion of the configuration, the unit transitions to the state as described in the IR STD (State Transition Diagram). This state will complete in less than 1 second.

Configured - This state shall indicate that the IR is ready to start the acquisition and tracking of the signal as specified by configuration.

Acquisition - This state shall indicate that the IR is attempting to acquire the signal as configured. Any reconfiguration command during this state with transition the unit to Configuration in Progress. Upon achieving PN code and carrier lock and symbol/decoder lock for at least one channel, the IR will transition to the Tracking state.

Track - This state shall indicate that the IR has achieved lock, and is tracking the signal as configured. This is the only state in which the Tracking Report data is valid. The IR will stay in this state until either loss of lock or a command requiring a state change is received (see IR STD). Upon loss of lock, the IR will transition to the Reacquisition state.

Reacquisition - This state shall indicate that the IR is attempting to reacquire the signal based on previous doppler and range information achieved during track. The IR shall stay in this state until either lock is achieved or a command requiring a state change is received (see IR STT).

F5.2.5 FORWARD MODEL SETUP REQUIREMENTS

a. The COMMON CONFIGURATION COMMAND shall be effective at least 1 second prior to the effective time of the START FORWARD MODEL COMMAND. This is necessary in order for the IR to process the setup data from the COMMON CONFIGURATION COMMAND so that the forward model can be started.

b. No ephemeris data shall be required to start forward model. Note, however, if the ephemeris has not been downloaded prior to the start of the forward model, the tracking data for coherent services will be of no value.

   Note: The PN code phase error is cumulative if the PN code rates of the forward service are not followed. If the forward doppler compensation table is not provided for the forward model, or is sent later than was supplied to the MDP, unrecoverable tracking errors will arise.

TABLE F5—2a. IR COMMAND STATE TABLE

State / Command	Sync/ Async	Confidence Test	Extended Bit	Standby	Conf. in Prog	Con - figured	Acquisi - tion	Track	Reacq
Set State Command	A								
- Reset			X	X	X	X	X	X	X
- Clear Ephem				X	X	X	X	X	X
- Clear Config				X	X	X	X	X	X
- Clear Both				X	X	X	X	X	X
- Start Extended BIT				X	X	X	X	X	X
- Stop Extended BIT			X						
Download (F/W)	N/A			X					
Download (Ephemeris)	N/A			X	X	X	X	X	X
Common Config Cmd	A			X	X	X	X	X	X
Specific Config Cmd	A			X	X	X	X	X	X
Start Acq	A				X	X	X	X	X
Expand Freq Search	A				X	X	X		
Burn Alert	A							X	
Zero Doppler Count	S							X	
FWD Freq. Sweep	S				X	X	X	X	X
FWD Doppler Control	S				X	X	X	X	X
FWD Break Lock	S				X	X	X	X	X
Cold Start	S				X	X			
Start FWD Model	S				X	X			

NOTES:

1. Synchronous command rejection due to state incompatibility is checked immediately
prior to execution of the command, not at receipt of the command.

TABLE F5—2b. (NOT USED)

TABLE F5—2c. IR STATE TRANSITION TABLE

Current State	Event	Action	Next State
POWER OFF	Power - On	Boot Exec and Application Execute Confidence Test	CONFIDENCE TEST IN PROGRESS
CONFIDENCE TEST IN PROGRESS	Test Complete	BIT status updated Disable expanded search	STANDBY
Any State	SET_STATE - Reset	Boot Exec and Application Execute Confidence Test	CONFIDENCE TEST IN PROGRESS
Any State except EXTENDED BIT	SET_STATE - Standby	Clear Config, Ephem, or Both Disable expanded search	STANDBY
	SET_STATE - Run Extended BIT	Run extended BIT	EXTENDED BIT (Goto STANDBY when complete)
EXTENDED BIT	SET_STATE - Halt Extended BIT or Completion of BIT	Stop extended BIT Place results in status Disable expanded search	STANDBY
STANDBY	SPECIFIC_CONFIG	Start Configuration	CONFIGURED (via config in prog)
CONFIGURATION IN PROGRESS (From Standby)	Configuration Complete	None	CONFIGURED
	EXPAND_FREQ_SRCH	Use expanded search window for next acquisition, i.e., enable expanded search	CONFIG IN PROG
CONFIGURED	START_ACQUISITION	Start Acquisition Disable expanded search	ACQUISITION
	SPECIFIC_CONFIG or COMMON_CONFIG	Configure Disable expanded search	CONFIGURED (via config in prog)
	EXPAND_FREQ_SRCH_SRCH	Use expanded search window for next Acquisition	CONFIG IN PROG
ACQUISITION	START_ACQUISITION	Reinitiate Acquisition	ACQUISITION
	EXPANDED_FREQ_SRCH	Restart Acquisition using expanded search window. Enable expnaded search	ACQUISITION
	SPEC_CONFIG (recovery) or COMMON_CONFIG	Stop Acq., Reconfigure, Resume Acquisition	CONFIGURED (via config in prog)

TABLE F5—2c. IR RETURN STATE TRANSITION TABLE (CONT)

Current State	Event	Action	Next State
ACQUISITION (cont)	SPEC_CONFIG (restart) or COMMON_CONFIG	Stop Acq., Reconfigure	CONFIGURED (via config in prog)
	Achieved Lock	Start tracking	TRACK
TRACK	ZERO_DOPPLER_CNT	Zero doppler counter	TRACK
	BURN_ALERT	Open windows for burn	TRACK
	*SPECIFIC_CONFIG (recovery)	Continue tracking Reconfigure in background	TRACK
	SPECIFIC_CONFIG (restart) or COMMON_CONFIG	Stop track Start Reconfigure	CONFIGURED (via config in prog)
	Three seconds elapsed.	Disable expanded search	TRACK
	START_ACQUISITION	Initiate new acquisition	ACQUISITION
	Loss of Lock	Initiate reacquisition	REACQUISITION
REACQUISITION	SPECIFIC_CONFIG (recovery)	Continue reacq Reconfigure in background	REACQUISITION
	SPECIFIC_CONFIG (restart)	Stop acq/track. Perform Reconfiguration	CONFIGURED (via config in prog)
	START_ACQUISITION	Initiate new acquisition	ACQUISITION
	Acquire Lock	Reinitiate tracking	TRACK

*If a mode changed from Mode 1 to Mode 3 or from Mode 3 to Mode 1, the ADPE will follow the recovery reconfiguration with a START ACQ command.

TABLE F5—2d. (DELETED)

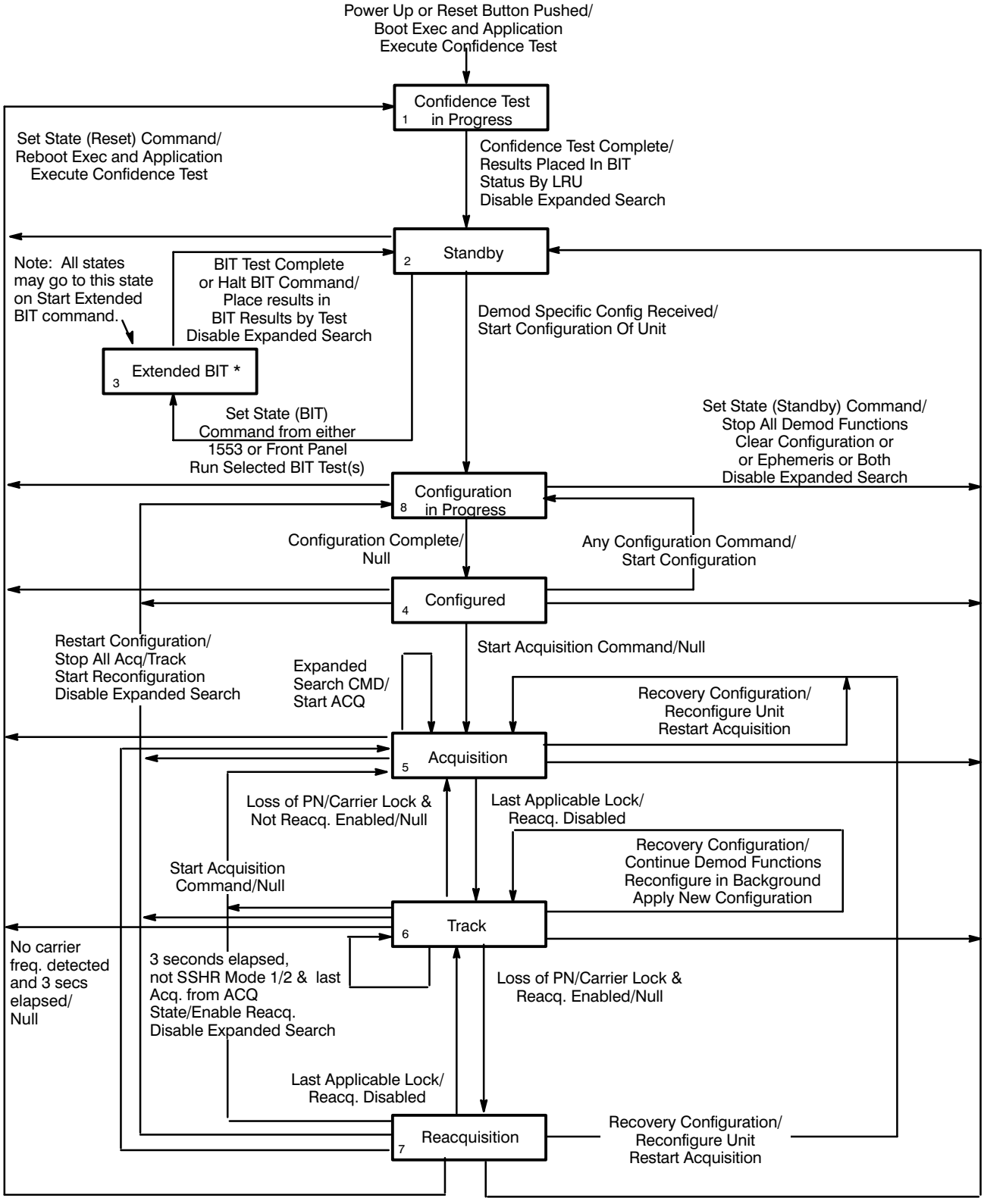


Figure F5—2. IR State Transition Diagram

c. For coherent services, the forward model must be started (via the START FORWARD MODEL COMMAND) prior to receipt of the START ACQUISITION COMMAND, so that the IR can use the PN code state for acquisition. Should the forward model not be started, the IR may not meet its acquisition or tracking requirements.

d. Receipt of a new START FORWARD MODEL COMMAND or COLD START COMMAND shall cause the forward model to restart and synchronize with the specified 1pps.

e. The following commands will cause the IR to restart the forward model from its internally availaible forward code state variables. This will cause a momentary delay (1 to 2 seconds) reporting, via IR_PERFORMANCE REPORT in the FORWARD MODEL STATUS field, that the forward model is inactive.

1.
   (a) IR is in a coherent mode in CONFIG, ACQ, TRACK or REACQ state.
   (b) The IR forward model is currently active.
   (c) AN IR_SPECIFIC_CONFIGURATION_COMMAND of type restart is sent to IR.

2.
   (a) IR is in a coherent mode in ACQ, TRACK or REACQ state.
   (b) An IR_START_ACQUISITION command is sent to IR.

These restarts of the forward model have the same constraints as an IR_COLD_START command. If the IR cannot immediately restart the forward model due to these constraints, it will suspend any state transitions until the constraint is removed, and then continue its normal state progression.

F5.2.6 (NOT USED)

F5.2.7 (NOT USED)

F5.2.8 COMMAND MEMORY

The IR shall provide a memory capability for the SPECIFIC and COMMON configuration commands. This will allow a null command (no bits set in the BIT MAP) to be sent to transition from one state to the next, provided the applicable data were supplied during a previous command transmission. The IR shall use the data from this last transmission to perform any necessary configurations.

A null command is always treated as a RESTART configuration.

F5.2.9 CONFIGURATION DATA REQUIREMENTS BY SERVICE TYPE

Transition from the STANDBY state to the CONFIGURED state, a minimum set of data shall be required, based on SERVICE TYPE. Table 5 - 4 checks off the minimum required command data parameters for the SPECIFIC CONFIGURATION COMMANDS required to be supplied by ADPE for each major service type. To start the FWD model, all command parameters shall be received. As specified, in paragraph 5.2.8, if a required parameter is not provided upon change of service type, but was previously downloaded, the IR shall use the previously specified value.

TABLE F5—3. (NOT USED)

TABLE F5—4. SPECIFIC CONFIGURATION DATA REQUIREMENTS

Command Data Parameters	KSAR	KSHR	SSAR	SSHR	MAR	MA CAL	RANGE ZERO SET
Service Type	X	X	X	X	X	X	X
Service Mode	X		X	X			
Setup Misc Parameters	X		X	X(1)	X		
I:Q Power Ratio	X(2)		X(2)		X(2)		
Data format (I and Q)	X	X	X	X	X		
Encoding (I and Q)	X		X		X		
Symbol format (I and Q)	X	X	X	X	X		
Operational Light							
Data Rate (I and Q)	X	X	X		X		
Single/Dual channel Mod.	X		X		X		
Return Link Mode 1 and 3 Taps	X(3)		X(3)		X(3)		X
Initial A Register Value	X(4)		X(4)		X(4)	X	
Initial C Register Value	X(4)		X(4)		X(4)	X	
SSA Combining Delay			X	X	(only when combining)		
Jitter (I and Q)	X	X	X	X	X		
Return IF Offset Frequency	X	X	X	X	X		
KSAR I and Q Data Recovery	X						
STGT Return Translation Freq	X	X	X	X	X		
TDRS Return Translation Freq	X	X	X	X	X		
Service Max Data Rate (I and Q)	X		X		X		

Notes:

1. Only the SSA combining on/off parameter of Setup Misc Parameters is applicable for SSHR.
2. For Dual Data channel configurations only
3. DG - 1, Modes 1 and 3 only
4. DG - 1, Mode 2 only

F5.3 IR STATUS REPORTING AND TIME—TAGGING

Status shall be collected and reported once per second and time tagged to a 1pps mark. Status reports time tagged "t_0" shall contain:

Integrated Status - Integrated status over the time period (t_0 - 1) to t_0. This includes lock status and doppler frequency status.

Snapshot Status - Status sampled at the 1pps reflecting equipment state or a measurement at the instant t_0. This shall include status that reflects a synchronous command with an effective time of t_0, as well as status that reflects an asynchronous command which took effect within the previous second.

Time Transfer Status - 1st and 2nd measurements of epochs relative to 1pps at t_0 - 1.

Status reports time tagged "t_0" shall be available for collection by the subsystem controller throughout the interval
(t_0 + 300ms) to (t_0 + 1 second)

Extended BIT Status shall be available from 300 ms of the 1 pps interval immediately following completion of the BIT, until start of the next Extended BIT.

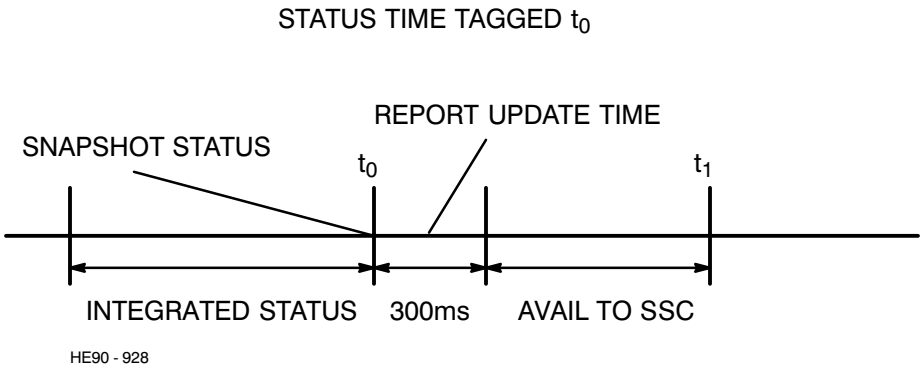


Figure F5—3. Status Reporting

F5.4 EPHEMERIS DOWNLOADING

a. The term "Ephemeris" shall be used to refer to frequency and delay profiles provided to the IR, for the purpose of this ICD.

b. The Download Command shall always precede the Ephemeris Data Command. The time spacing between these commands shall be limited only by the 1553b rate.

c. Ephemeris downloading shall follow a "2 - 10 - 2" rule.

   2 - 10 - 2 Rule:
   Ephemeris data shall be required two seconds in advance of its use and received at a rate not to exceed ten minutes of ephemeris data in any two second period.

The ADPE shall ensure sufficient timing margins to compensate for any timing uncertainties, so that the above requirements are met.

Ephemeris processing requires up to ten seconds starting from the completion of an ephemeris data download. If processing takes longer, the unit shall use the first point that it can as a safe-guard. The unit will use the data from the previous download until it is ready to switch to the data in the new download. The unit shall use the first point in the new download that it can. If no ephemeris data has been downloaded, the unit shall assume zero doppler and zero range.

d. Commands may be received during ephemeris data download.

e. Ephemeris data shall be rejected if the time of first data point is greater than 60 minutes into the future.

f. If, at any time, the IR runs out of valid ephemeris data, it shall continue using its last valid data point, until new ephemeris data are supplied.

F5.5 SUBSYSTEM CONTROLLER STATUS COLLECTION

Upon receipt of the 1PPS epoch command from the ADPE, the SSC shall initiate a delay of 300 ms prior to collecting the IR status when IR tables have been selected by the ADPE. The SSC shall collect the status within a 550 ms window following the delay, which will be reported to ADPE upon receipt of the next transmit status command. Figure 5 - 4 shows a timeline of the status collection process.

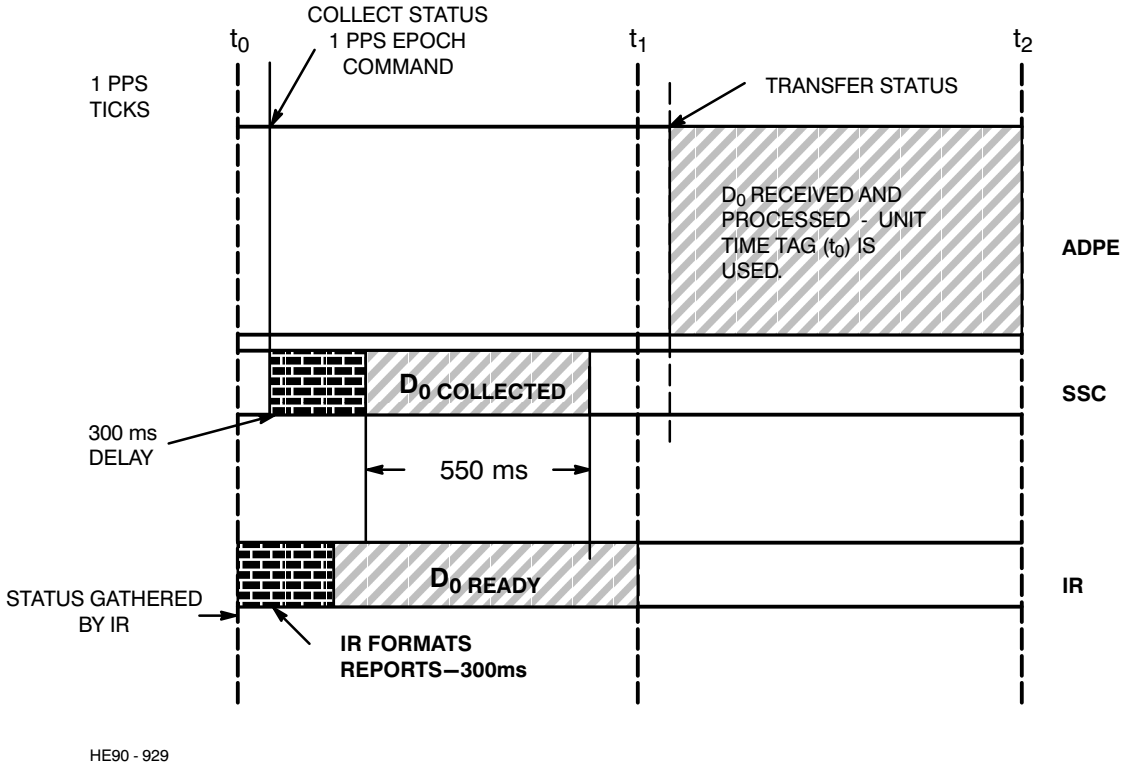


Figure F5—4. IR Status Collection Window

SECTION F6
FORMAT CONTROL LEVEL

F6.1 GENERAL

This section describes the Format Control Level interactions of the IR - SSC/ADPE interface (interaction 2 of Figure F4 - 1).

F6.2 MESSAGE FORMATS

F6.2.1 FORMAT STRUCTURE

All message formats between the IR and the SSC/ADPE shall contain a Start Checkword and an End Checkword as shown in each message. In addition, all message lengths shall contain an even number of bytes, less than or equal to 64, so that the message format may conform to a 1553 data transfer as one data block. The exception is ephemeris data which may be sent in as many blocks and bytes as is necessary up to 9606 words. In addition, note that all data parameters which are either 2 bytes or 4 bytes in length must start on a full 1553 word (odd byte) boundary.

F6.2.2 COMMAND FIELD DEFINITIONS

The command format is defined by the contents of the command fields shown below.

BYTE #	BIT # S	TYPE	RANGE	UNITS	RESOLUTION	DESCRIPTION

These fields are defined as follows:

BYTE No. specifies the byte number(s) of the associated command parameter, relative to its position in the command. Where a parameter is defined over several bytes, the leftmost, lowest numbered byte contains the MSB (most significant bit).

BIT No.s specifies the bit numbers within the byte(s) of the associated parameter. Bit 0 is always the LSB.

TYPE specifies the data representation. Three data types are used in this ICD. These consist of:

BIN - Binary indicates that the data specified in the range field will be in a binary format, with the LSB specified in the resolution field. All negative numbers shall be represented in binary 2's complement format. The range field for binary is specified in decimal.

HEX - HEX is used to specify that the range field has been specified in HEX. This has been used to specify the Start and End Checkwords.

OCT - Octal is used for PN codes to indicate that the range as well as the data is to be read and transferred in an octal format, where each digit is represented by three bits.

RANGE specifies the range of allowable values that a parameter may take on. The range for BINARY types are specified in decimal, HEX is in hex, and OCT is in octal. The range is described in terms of the units, unless otherwise specified.

UNITS define the units of measurement of this parameter.

RESOLUTION specifies the value of the LSB for the associated parameter. Unless otherwise specified, the resolution is in terms of the units.

DESCRIPTION provides the name of the parameter (in bold face capital letters), any subparameters (in non - bold face capital letters), and a description of that parameter.

F6.2.3 STATUS FIELD DEFINITIONS

The status fields are identical to the command fields, except that an additional field, ACCURACY, is provided.

ACCURACY specifies the accuracy of a measurement, with respect to its resolution. Accuracy does not impose requirements on the IR but reflects actual design.

F6.2.4 RESERVED FIELDS

Fields marked ”Reserved” are for IEC use or to preserve commonalty of “inter - unit commands” only and should be set to zero. These fields shall not be considered spares. Fields labeled as ”Spare” are available for future use.

F6.3 IR COMMANDS

SUMMARY OF INTEGRATED RECEIVER (IR) COMMANDS:

Configuration Commands:

IR_SPECIFIC_CONFIGURATION_COMMAND

IR_COMMON_CONFIGURATION_COMMAND

Ephemeris Commands:

IR_DOWNLOAD_COMMAND

IR_EPHEMERIS_DATA_COMMAND

Receiver Control Commands:

IR_SET_STATE_COMMAND

IR_BURN_ALERT_COMMAND

IR_EXPAND_FREQ_SEARCH_WINDOW_COMMAND

IR_START_ACQUISITION_COMMAND

IR_ZERO_DOPPLER_COUNT_COMMAND

Forward Model Control Commands:

IR_FWD_FREQUENCY_SWEEP_COMMAND

IR_FWD_BREAK_LOCK_COMMAND

IR_FWD_DOPPLER_COMP_CONTROL_COMMAND

IR_START_FORWARD_MODEL_COMMAND

IR_COLD_START_COMMAND

IR_SET_STATE_COMMAND

Description:

Type: Asynchronous

Used to reset unit, put unit into standby, run extended BIT, and halt extended BIT. When put into standby, this command can be setup to clear ephemeris, configuration, or both.

Command Verification: None

Format:

BYTE #	BIT # S	TYPE	RANGE	UNITS	RESOLUTION	DESCRIPTION
1,2	15 - 0	HEX	AA55	N/A	N/A	**START CHECKWORD**
3	7 - 0	BIN	N/A	N/A	N/A	**SPARE**
4	7 - 0	BIN	1 TO 4	N/A	N/A	**INITIALIZATION TYPE:** 1 = RESET IR will perform reboot and confidence test 2 = STANDBY Puts IR Forward Model and Receiver in standby state. Acquisition lost. 3 = RUN EXTENDED BIT Runs a sequence of BIT tests whose results will be made available via the Extended BIT report. 4 = HALT EXTENDED BIT Halts upon completion of current test. To do an immediate halt, use RESET.

IR_SET_STATE_COMMAND cont.

BYTE #	BIT # S	TYPE	RANGE	UNITS	RESOLUTION	DESCRIPTION
5,6	15 - 0	BIN	0 TO 3	N/A	N/A	**INITIALIZATION DATA:** Compliments initialization type as follows: 0 = N/A (Use when data initialization type is not standby. 1 = STANDBY CLEAR EPHEMERIS Clears out any ephemeris data previously sent and initializes ephemeris related data for receipt of new data. 2 = STANDBY CLEAR CONFIGU - RATION Clears out any configuration data previously sent and initializes configuration related data for receipt of new config. data 3= STANDBY CLEAR CONFIG and EPHEMERIS Executes both the Clear Ephemeris and Clear Configuration above.
7,8	15 - 0	HEX	55AA	N/A	N/A	**END CHECKWORD**

IR_SPECIFIC_CONFIGURATION_COMMAND

Description:

Type: Asynchronous

This configuration command contains configuration items that are specific to the IR (not common or synchronous to the MDP or PTE). This command is used for initial configuration or reconfiguration of the IR. The IR reads only the parameters demarcated in the configuration bit map. All others are ignored.

The IR will configure or reconfigure parameters specified in the configuration bit map according to the new data indicated.

Command Verification:

SPECIFIC CONFIGURATION REPORT

Each parameter in the command shall be reflected under a similar name in the configuration report.

Format:

IR_SPECIFIC_CONFIGURATION_COMMAND cont.

BYTE #	BIT # S	TYPE	RANGE	UNITS	RESOLUTION	DESCRIPTION
1,2	15 - 0	HEX	AA55	N/A	N/A	**START CHECKWORD**
3	7 - 0	BIN	0 OR 1	N/A	N/A	***FREQUENCY OR PN SEARCH RANGE** 0 = NORMAL SEARCH RANGE 1 = EXPANDED SEARCH RANGE
4	7 - 0	BIN	0 - 100	dB - Hz	LSB = 1 dB	****REFERENCE C/N_0** The expected C/N_0 at the IR's IF input. For user services, IR performance requirements apply for actual input C/N_0 values over the range - 3 dB to +12 dB relative to the commanded reference C/N_0.
5 - 8	31 - 0	BIN		N/A	N/A	**CONFIGURATION ITEM BIT MAP** This field identifies whether or not a particular configuration data item is valid. Only items with their corresponding bit set to "1" in the bit map will be updated.
	0					SPARE
	1		0 OR 1			FREQUENCY SEARCH RANGE
	2		0 OR 1			MODULATION INDEX
	3		0 OR 1			SUBCARRIER FREQUENCY
	4		0 OR 1			REFERENCE C/N_0
	5		0 OR 1			SERVICE MODE
	6		0 OR 1			SERVICE MAX I DATA RATE
	7		0 OR 1			SERVICE MAX Q DATA RATE
	8		0 OR 1			SERVICE TYPE
	9		0 OR 1			SETUP MISCELLANEOUS PARAMETERS SSA Combining, SSA deinterleaving, G2 inversion setup.
	10		0 OR 1			I/Q POWER RATIO
	11		0 OR 1			I DATA FORMAT
	12		0 OR 1			Q DATA FORMAT
	13		0 OR 1			I ENCODING
	14		0 OR 1			Q ENCODING
	15		0 OR 1			I SYMBOL FORMAT
	16		0 OR 1			Q SYMBOL FORMAT
	17		0 OR 1			OPERATIONAL LIGHT
	18		0 OR 1			I DATA RATE
	19		0 OR 1			Q DATA RATE
	20		0 OR 1			SINGLE/DUAL CHANNEL MODULATION
	21		0 OR 1			RTN LINK MODE 1&3 FEEDBACK TAPS
	22		0 OR 1			INITIAL A REGISTER VALUE
	23		0 OR 1			INITIAL C REGISTER VALUE
	24		0 OR 1			SSA COMBINING DELAY
	25		0 OR 1			I SYMBOL JITTER
	26		0 OR 1			Q SYMBOL JITTER
	27		0 OR 1			RETURN IF OFFSET FREQUENCY
	28		0 OR 1			KSAR I - CHANNEL DATA RECOVERY
	29		0 OR 1			KSAR Q - CHANNEL DATA RECOVERY
	30		0 OR 1			STGT RETURN TRANSLATION FREQ
	31		0 OR 1			TDRS RETURN TRANSLATION FREQ

*For DG1, coherent services, expands PN search range. For all non-coherent services, expands frequency search range.
**For MA CAL modes, always command the IR to reference C/N_0 of 27 dB - Hz, independent of actual C/N_0.

IR_SPECIFIC_CONFIGURATION_COMMAND cont.

BYTE #	BIT # S	TYPE	RANGE	UNITS	RESOLUTION	DESCRIPTION
9	7 - 0	BIN	1 TO 29	N/A	N/A	**SERVICE TYPE** 1 = KSAR, DG-1, MODE 1 OR 3 2 = KSAR, DG-1, MODE 2 3 = SPARE 4 = KSAR, DG-2, MODE 1 5 = KSAR, DG-2, MODE 2 6 = KSHR, MODE 1(NON-COHERENT - Modulated carrier and subcarrier on 370 MHz input) 7 = KSHR, MODE 2 (NON-COHERENT - Modulated subcarrier on 8.5 MHz input) 8 = SSAR, DG-1, MODE 1 OR 3 9 = SSAR, DG-1, MODE 2 10 = SPARE 11 = SSAR, DG-2, MODE 1 12 = SSAR, DG-2, MODE 2 13 = SSHR, MODE 1 OR 2, COHERENT 14 = SSHR, MODE 1 OR 2, NON-COHERENT 15 = SPARE 16 = SPARE 17 = SSHR, MODE 3 (COHERENT) 18 = MAR, DG-1, MODE 1 19 = MAR, DG-1, MODE 2 20 = RESERVED(KSAF) 21 = RESERVED(KSHF) 22 = RESERVED(SSAF) 23 = RESERVED(SSHF) 24 = SPARE 25 = RESERVED(MAF) 26 = MA CALIBRATION 27 = KSA RANGE ZERO SET 28 = SSA RANGE ZERO SET 29 = MA RANGE ZERO SET
10	7 - 0	BIN	1 TO 3	N/A	N/A	SERVICE MODE Provides further description for service types 1, 8, 13, and 14 1 = MODE 1 2 = MODE 2 (SSHR only) 3 = MODE 3 (DG-1 only)

IR_SPECIFIC_CONFIGURATION_COMMAND cont.

BYTE #	BIT # S	TYPE	RANGE	UNITS	RESOLUTION	DESCRIPTION
11	7 - 0	BIN				**SETUP MISCELLANEOUS PARAMETERS**
	0		0 OR 1	N/A	N/A	SSA COMBINING ENABLE FOR SSAR AND SSHR: 1 = COMBINING ON Configures IR as a combining receiver of digitized (5 bits) baseband data.
	1		0 OR 1	N/A	N/A	SSA DEINTERLEAVING I: 1 =ON 0 = OFF
	2		0 OR 1	N/A	N/A	SSA DEINTERLEAVING Q: 1 = ON 0 = OFF
	3					SPARE
	4		0 OR 1	N/A	N/A	I DECODING G2 INVERSION 1 = INVERTED 0 = NOT INVERTED
	5		0 OR 1	N/A	N/A	Q DECODING G2 INVERSION 1 = INVERTED 0 = NOT INVERTED
	6 - 7					SPARE
12	7 - 0	BIN	- 6 dB to 0 dB or +6 dB	dB	LSB = 0.1	**I/Q POWER RATIO, SINGLE/DUAL CHANNEL MODULATION = 1—6** - OR -
			0.2 TO 1.5, or 0	radians	LSB = 0.1	**MODULATION INDEX, SINGLE/DUAL CHANNEL MODULATION = 7—9** Bits 0 thru 7 are represented as integer (2s complement for negative numbers) with a scale factor of 10 . Bit 7 is the sign bit. To convert this unit to dB, divide the integer number by the scale factor.
13	7 - 0	BIN	1 TO 6	N/A	N/A	**I DATA FORMAT** 1 = NRZ - L 2 = NRZ - M 3 = NRZ - S 4 = BIPhase - L 5 = BIPhase - M 6 = BIPhase - S

IR_SPECIFIC_CONFIGURATION_COMMAND cont.

BYTE #	BIT # S	TYPE	RANGE	UNITS	RESOLUTION	DESCRIPTION
14	7 - 0	BIN	1 TO 6	N/A	N/A	**Q DATA FORMAT** 1 = NRZ - L 2 = NRZ - M 3 = NRZ - S 4 = BIPhase - L 5 = BIPhase - M 6 = BIPhase - S
15	7 - 0	BIN	1 TO 4	N/A	N/A	**I ENCODING** 1 = UNCODED (For SSAR, specifies decoder bypass) 2 = CODE 1 (R=1/2) 3 = CODE 2 (R=1/2) 4 = CODE 3 (R=1/3) 5 = CODE 4 (R=1/3, SHUTTLE)
16	7 - 0	BIN	1 TO 4	N/A	N/A	**Q ENCODING** 1 = UNCODED (For SSAR, specifies decoder bypass) 2 = CODE 1 (R=1/2) 3 = CODE 2 (R=1/2) 4 = CODE 3 (R=1/3) 5 = CODE 4 (R=1/3, SHUTTLE)
17	7 - 0	BIN	1 TO 2	N/A	N/A	**I SYMBOL FORMAT** 1 = NRZ 2 = BIPHASE
18	7 - 0	BIN	1 TO 2	N/A	N/A	**Q SYMBOL FORMAT** 1 = NRZ 2 = BIPHASE
19	7 - 0	BIN	1 TO 3	N/A	N/A	**OPERATIONAL LIGHT** 1 = ONLINE 2 = STANDBY 3 = MAINTENANCE

IR_SPECIFIC_CONFIGURATION_COMMAND cont.

BYTE #	BIT # S	TYPE	RANGE	UNITS	RESOLUTION	DESCRIPTION
20	7 - 0	BIN	1 TO 9	N/A	N/A	**SINGLE / DUAL CH. MODULATION** 1 = I CHANNEL BPSK 2 = Q CHANNEL BPSK 3 = SINGLE CHANNEL DG - 1 QPSK 4 = SINGLE CHANNEL SQPSK ALT DATA BITS 5 = SINGLE CHANNEL SQPSK ALT CODED SYMBOLS 6 = DUAL CHANNEL QPSK 7 = SINGLE CHANNEL PM 8 = SINGLE CHANNEL SINEWAVE SUBCARRIER 9 = SINGLE CHANNEL SQUAREWAVE SUBCARRIER
21 - 24	31 - 0	BIN	100 TO 300,000,000	BPS	LSB = 1	**I DATA RATE** Data rate is specified as an integer number. (Data recovery not required above 12 Mbps)
25 - 28	31 - 0	BIN	100 TO 150,000,000	BPS	LSB = 1	**Q DATA RATE, SINGLE/DUAL CHANNEL MODULATION = 1—6** Data rate is specified as an integer number. (Data recovery not required above 6 Mbps) - OR -
			25,000 TO 3,000,000	Hz	LSB = 1	**SUBCARRIER FREQUENCY, SINGLE/ DUAL CHANNEL MODULATION = 8—9**
29 - 32	31 - 0					**RETURN LINK DG1 MODE 1 & 3 FEEDBACK TAPS**
	20 - 0	OCT	1000000 TO 1777777	N/A	N/A	Tap values
	31 - 21	BIN	0	N/A	N/A	Zero pads. Not used for data.
33,34	15 - 0					**INITIAL A REGISTER VALUE**
	10 - 0	OCT	0001 TO 3777	N/A	N/A	11 bit initial value
	15 - 11	BIN	0	N/A	N/A	Zero pads. Not used for data.
35,36	15 - 0					**INITIAL C REGISTER VALUE**
	10 - 0	OCT	0001 TO 3777	N/A	N/A	11 bit initial value
	15 - 11	BIN	0	N/A	N/A	Zero pads. Not used for data

IR_SPECIFIC_CONFIGURATION_COMMAND cont.

BYTE #	BIT # S	TYPE	RAN1E	UNITS	RESOLUTION	DESCRIPTION
37,38	15 - 0	BIN	0 - 300	nsec	LSB = 1	**SSA COMBINING DELAY**
39	7 - 0	BIN	0 TO 3	N/A	N/A	**I SYMBOL JITTER** 0 = NONE 1 = 0.01% 2 = 0.1% 3 = 2.0%
40	7 - 0	BIN	0 TO 3	N/A	N/A	**Q SYMBOL JITTER** 0 = NONE 1 = 0.01% 2 = 0.1% 3 = 2.0%
41 - 44	31 - 0	BIN	- 2 MHz to + 2 MHz	HZ	LSB = 1 Hz	**RETURN IF OFFSET FREQUENCY, df_R**
45	7 - 0	BIN	0 OR 1	N/A	N/A	**KSAR I—CHANNEL DATA RECOVERY** 0 = DATA RECOVERY NOT REQUIRED 1 = DATA RECOVERY REQUIRED
46	7 - 0	BIN	0 OR 1	N/A	N/A	**KSAR Q—CHANNEL DATA RECOVERY** 0 = DATA RECOVERY NOT REQUIRED 1 = DATA RECOVERY REQUIRED
47 - 50	31 - 0	BIN	0 MHz to - 14000 MHz	Hz	LSB = 1kHz	**STGT RETURN TRANSLATION FREQUENCY, f_{trg}** Specifies the frequency translation of the STGT downconverters.
51 - 54	31 - 0	BIN	- 2500 MHz to +11500 MHz	Hz	LSB = 1kHz	**TDRS RETURN TRANSLATION FREQUENCY, f_{trt}** Specifies the return frequency translation through the TDRS.
55 - 58	31 - 0	BIN	100 - 300M	BPS	LSB=1	**SERVICE MAX I DATA RATE**
59 - 62	31 - 0	BIN	100 - 150M	BPS	LSB=1	**SERVICE MAX Q DATA RATE**
63 - 64	15 - 0	HEX	55AA	N/A	N/A	**END CHECKWORD**

IR_COMMON_CONFIGURATION_COMMAND

Description:

Type: Asynchronous

The Common Configuration Command contains configuration parameters which are common with the associated MDP for coherent services. These parameters are used to setup the Forward Model. The IR reads only the parameters demarcated in the configuration bit map. All others are ignored.

The IR will configure or reconfigure parameters specified in the configuration bit map according to the new data indicated.

Command Verification:

COMMON CONFIGURATION REPORT

Each parameter in the configuration command is under a similar name in the configuration report.

Format:

BYTE #	BIT # S	TYPE	RANGE	UNITS	RESOLUTION	DESCRIPTION
1,2	15 - 0	HEX	AA55	N/A	N/A	**START CHECKWORD**
3 - 6	31 - 0					**SPARE**
7,8	15 - 0	BIN		N/A	N/A	**BIT MAP**
	0		0 OR 1			1 = FWD IF OFFSET FREQUENCY
	1		0 OR 1			1 = FWD TRANSLATION FREQ
	2		0 OR 1			RESERVED (PN MODULATION CONFIGURATION)
	3		0 OR 1			1 = DOPPLER CONFIGURATION
	4		0 OR 1			1 = FWD SWEEP SELECT
	5		0 OR 1			1 = GN FWD SWEEP DURATION
	6		0 OR 1			1 = GN FWD SWEEP RANGE
	7 - 15					SPARES
9 - 12	31 - 0	BIN	- 2M to +2M	Hz	LSB = 1 Hz	**FORWARD IF OFFSET FREQUENCY, df_F** Specifies fixed offset to apply to 370 MHz for base IF
13 - 16	31 - 0	BIN	1000 MHz to 13500 MHz	Hz	LSB = 1K	**FORWARD TRANSLATION FREQUENCY, f_{tf}** (370 MHz + OFFSET + FWD TRANS = USER RECEIVE FREQUENCY)

IR_COMMON_CONFIGURATION_COMMAND cont.

BYTE #	BIT # S	TYPE	RANGE	UNITS	RESOLUTION	DESCRIPTION
17	7 - 0	BIN	0 OR 1	N/A	N/A	**RESERVED (FORWARD PN MODULATION CONFIGURATION)**
18	7 - 0	BIN				**FORWARD DOPPLER COMPENSATION CONFIGURATION**
	0		0 OR 1	N/A	N/A	1 = FWD CARRIER DOPPLER COMP ACTIVE This will tell the IR forward model the initial MDP doppler comp configuration.
	1					RESERVED (FWD PN DOPPLER COMP ACTIVE - Shuttle)
	2 - 7					SPARES
19	7 - 0	BIN	1 OR 2	N/A	N/A	**GN/SN FORWARD SWEEP SELECT** 1 = SN SWEEP 2 = GN SWEEP
20	7 - 0	BIN	1 TO 120	SECONDS	LSB = 1	**GN FORWARD SWEEP DURATION**
21, 22	15 - 0	BIN	10 TO 600,000	Hz	LSB = 10	**GN FORWARD SWEEP RANGE**
23 - 24	15 - 0	HEX	55AA	N/A	N/A	**END CHECKWORD**

IR_DOWNLOAD_COMMAND

Description:

Type: N/A

Used to notify the IR that an ephemeris block (or firmware - not used by ADPE) download is following. This command must be sent prior to sending an ephemeris data block.

Command Verification:

PERFORMANCE REPORT

Observe EPHEMERIS STATUS for UPDATE COMPLETE after the ephemeris data has been downloaded. The unit has up to ten seconds from receipt of the last data point to complete the processing. This command shall cause the UPDATE COMPLETE parameter to be reset. It shall set upon processing completion.

Format:

BYTE #	BIT # S	TYPE	RANGE	UNITS	RESOLUTION	DESCRIPTION
1,2	15 - 0	HEX	AA55	N/A	N/A	**START CHECKWORD**
3	7 - 0	BIN	N/A	N/A	N/A	**SPARE**
4	7 - 0	BIN	1 TO 2	N/A	N/A	**DOWNLOAD TYPE:** 1 = DOWNLOAD EPHEMERIS 2 = DOWNLOAD FIRMWARE (RESERVED FOR IEC USE.)
5 - 8	31 - 0	BIN	0 - 9606	16 BIT WORDS	1 WORD	**1553 WORD COUNT** If Download type field contains 1 then this field specifies No. of 1553 words of Ephemeris. If 2, this field specifies No. of words of MCP Firmware
9,10	15 - 0	BIN	0	N/A	N/A	**RESERVED FOR IEC USE**
11,12	15 - 0	HEX	55AA	N/A	N/A	**END CHECKWORD**

IR_EPHEMERIS_DATA_COMMAND

Description:

Provides ephemeris data. Data may contain any or all of the available ephemeris tables, including the DOPPLER COMPENSATION TABLE, DOPPLER PRE - CORRECTION TABLE, DELAY TABLE, and TDRS DOPPLER TABLE. This data is used to aid in acquisition and tracking. A brief description of these tables is given below.

The TABLE SELECT BIT MAP is used to specify the tables that are to be sent. Tables, if sent, shall be in the order specified by the format. This is a variable length table. If a table is not sent, there shall be no unused bytes inserted in its place. All tables within a download shall have the same length (same number of points). Each data point represents the ephemeris at half second increments. The time represents the time of the first data point.

The DOPPLER COMPENSATION TABLE provides the same frequency profile as provided to an associated MDP during coherent service. This is supplied to the IR for all coherent user services.

The DOPPLER PRE - CORRECTION TABLE supplies the expected frequency profile of the IR's IF input. These frequencies are provided for all user services.

The DELAY TABLE, in nanoseconds, represents the predicted round trip delay from the associated MDP, to the IR, for coherent services. The delay profile is provided for all coherent services. The IR uses this profile for predicting the received PN code state for acquisition and tracking, resolving ambiguity in range delay measurement, removing compensation for 2 - way doppler measurements, and time bias estimation for DG1 mode 1 and 3 and DG2 mode 1 services. For shuttle services, this is used for 2 - way doppler measurements only.

The TDRS DOPPLER TABLE contains round - trip estimated doppler frequency shifts of the TDRS return translation frequency.

This profile is used in PN code aiding of carrier acquisition, or carrier aiding of PN code acquisition.

Command Verification:

PERFORMANCE REPORT

Observe EPHEMERIS STATUS for UPDATE COMPLETE after the ephemeris data has been downloaded. The unit has up to ten seconds from receipt of the last data point to complete the processing.

Format:

IR_EPHEMERIS_DATA_COMMAND cont.

BYTE #	BIT # S	TYPE	RANGE	UNITS	RESOLUTION	DESCRIPTION
1,2	15 - 0	HEX	AA55	N/A	N/A	**START CHECKWORD**
3	7 - 0	BIN	0 - 23	HOURS	LSB = 1	**TIME OF FIRST POINT – HOURS**
4	7 - 0	BIN	0 - 59	MINUTES	LSB = 1	**TIME OF FIRST POINT – MINUTES**
5	7 - 0	BIN	0 - 59	SECONDS	LSB = 1	**TIME OF FIRST POINT – SECONDS**
6	7 - 0	BIN				**SPARE**
7,8	15 - 0	BIN	0 - 1200	# POINTS	1	**NUMBER OF POINTS PER TABLE (N)**
9,10	15 - 0					**TABLE SELECT BIT MAP**
	0	BIN	0 OR 1	N/A	N/A	1 = DOPPLER COMP TABLE
	1	BIN	0 OR 1	N/A	N/A	1 = DOPPLER PRE - CORR TABLE
	2	BIN	0 OR 1	N/A	N/A	1 = DELAY TABLE
	3	BIN	0 OR 1	N/A	N/A	1 = TDRS DOPPLER TABLE
	4 - 15					SPARES
X,X,X,X	31 - 0	BIN	- 2 MHz to + 2 MHz	Hz	0.01	**DOPPLER COMPENSATION TABLE – POINT 1** THRU
	same	same	same	same	same	**POINT N**
	31 - 0	BIN	- 2 MHz to + 2 MHz	Hz	0.01	**DOPPLER PRE–CORRECTION TABLE – POINT 1** THRU
	same	same	same	same	same	**POINT N**
	31 - 0	BIN	0 to 10^9	nsec	1	**DELAY TABLE – POINT 1** THRU
	same	same	same	same	same	**POINT N**
	31 - 0	BIN	- 10 kHz to+10 kHz	Hz	.01	**TDRS DOPPLER TABLE – POINT 1** THRU
	same	same	same	same	same	**POINT N**
Y,Y	15 - 0	HEX	55AA	N/A	N/A	**END CHECKWORD**

*** N is the number of points per table.**

IR_BURN_ALERT_COMMAND

Description:

Type: Asynchronous

Notifies IR of the transitions to powered or free flight so that it may adjust its tracking loop bandwidth.

Command Verification:

PERFORMANCE REPORT

The RECEIVER CONTROL STATUS parameter shall be set to indicate BURN ALERT IN PROGRESS upon receipt of this command. This status is reset at the end of the transition uncertainty time.

Format:

BYTE #	BIT # S	TYPE	RANGE	UNITS	RESOLUTION	DESCRIPTION
1,2	15 - 0	HEX	AA55	N/A	N/A	**START CHECKWORD**
3	7 - 0	BIN	N/A	N/A	N/A	**SPARE**
4	7 - 0	BIN	0 OR 1	N/A	N/A	**TRANSITION TO POWERED/ FREE FLIGHT** 0 = Trans to Free 1 = Trans to Powered
5	7 - 0	BIN	0 - 30	SEC	LSB=1	**UNCERTAINTY TIME** Specifies the time uncertainty of the beginning of the transition, from the time of command receipt.
6	7 - 0	N/A	N/A	N/A	N/A	**SPARE**
7,8	15 - 0	HEX	55AA	N/A	N/A	**END CHECKWORD**

IR_EXPAND_FREQUENCY_SEARCH_WINDOW_COMMAND

Description:

Type: Asynchronous

This command shall only be issued after a start of service. This command causes the IR to open its search windows for acquisition in the case of uncertainty in the user transmit frequency for mode 2(non - coherent) operations. The IR shall return to mode 2A after successful acquisition.

Command Verification:

PERFORMANCE REPORT

The RECEIVER CONTROL STATUS parameter shall set the EXPANDED FREQUENCY SEARCH IN PROGRESS indicator. Successful acquisition shall cause the IR to reset the EXPANDED FREQUENCY SEARCH IN PROGRESS indicator.

Note: Should the expanded frequency search cause a rapid acquisition, this field may not be observed. Therefore, also observe OPERATING STATE for TRACK during the next status report update (after 2 seconds is up) if EXPANDED FREQUENCY SEARCH IN PROGRESS is not verified.

Format:

BYTE #	BIT # S	TYPE	RANGE	UNITS	RESOLUTION	DESCRIPTION
1,2	15 - 0	HEX	AA55	N/A	N/A	**START CHECKWORD**
3,4	15 - 0	HEX	55AA	N/A	N/A	**END CHECKWORD**

IR_START_ACQUISITION

Description:

Type: Asynchronous

Initiates or reinitiates acquisition when configuration information has been processed.

Command Verification:

PERFORMANCE REPORT

The OPERATING STATE parameter shall be set for ACQUISITION, during the acquisition state.

Note: If acquisition occurs very quickly, it is possible that the next state observed is TRACK. When used by the ADPE in response to a Return Reacquisition Request while the unit is in TRACK mode, lock should be lost temporarily.

Format:

BYTE #	BIT # S	TYPE	RANGE	UNITS	RESOLUTION	DESCRIPTION
1,2	15 - 0	HEX	AA55	N/A	N/A	**START CHECKWORD**
3,4	15 - 0	HEX	55AA	N/A	N/A	**END CHECKWORD**

IR_ZERO_DOPPLER_COUNT

Description:

Type: Synchronous

This command specifies the time to zero the doppler counter. Sent at the start of a tracking service to zero the doppler counter (and synchronous with the 1pps).

Command Verification:

TRACKING REPORT

The 1 - SECOND AVERAGE DOPPLER parameter shall indicate a zero (0) in the report for the report whose time tag is equal to the effective time of this command. This is the only report time that shall reflect a zero in response to this command.

Format:

BYTE #	BIT # S	TYPE	RANGE	UNITS	RESOLUTION	DESCRIPTION
1,2	15 - 0	HEX	AA55	N/A	N/A	**START CHECKWORD**
3	7 - 0	BIN	0 - 23	HOURS	LSB = 1	**EFFECTIVE TIME HOURS**
4	7 - 0	BIN	0 - 59	MINUTES	LSB = 1	**EFFECTIVE TIME MINUTES**
5	7 - 0	BIN	0 - 59	SECONDS	LSB = 1	**EFFECTIVE TIME SECONDS**
6	7 - 0	N/A	N/A	N/A	N/A	**RESERVED**
7,8	15 - 0	HEX	55AA	N/A	N/A	**END CHECKWORD**

IR_FORWARD_FREQUENCY_SWEEP_COMMAND

Description: Initiates forward sweep in the forward model.

Type: Synchronous

This command indicates to the IR that the MDP is performing a forward sweep. The IR will simulate this in its forward model. There is no sweep for shuttle users.

The sweep offset added by this command shall be removed by receipt and execution of a IR_FORWARD_DOPPLER_COMP_CONTROL_CMD, IR_START_FORWARD_MODEL_CMD, or IR_COLD_START_CMD.

Command Verification:

PERFORMANCE REPORT

The FORWARD SWEEP IN PROGRESS indicator in the FORWARD MODEL STATUS parameter shall be set in response to a forward sweep, and reset upon its completion.

The FORWARD MODEL SWEEP BIAS indicator shall set the state of the forward bias when execution of this command is complete. The resetting of this bias is discussed in the appropriate commands.

Format:

BYTE #	BIT # S	TYPE	RANGE	UNITS	RESOLUTION	DESCRIPTION
1,2	15 - 0	HEX	AA55	N/A	N/A	**START CHECKWORD**
3	7 - 0	BIN	0 - 23	HOURS	LSB = 1	**EFFECTIVE TIME HOURS**
4	7 - 0	BIN	0 - 59	MINUTES	LSB = 1	**EFFECTIVE TIME MINUTES**
5	7 - 0	BIN	0 - 59	SECONDS	LSB = 1	**EFFECTIVE TIME SECONDS**
6	7 - 0	BIN	0 - 12	N/A	LSB = 1	**NUMBER OF SWEEPS**
7,8	15 - 0	HEX	55AA	N/A	N/A	**END CHECKWORD**

IR_FORWARD_BREAK_LOCK_COMMAND

Description:

Type: Synchronous

This command notifies the IR that the MDP is performing a forward break lock so that it may be simulated in the Forward Model. The break lock command causes the MDP to initiate an abrupt frequency change in output frequency. The step size is typically 1 MHz.

Command Verification:

PERFORMANCE REPORT

The FORWARD BREAK LOCK IN PROGRESS indicator in the FORWARD MODEL STATUS parameter shall be set for the duration of the break lock.

Format:

BYTE #	BIT # S	TYPE	RANGE	UNITS	RESOLUTION	DESCRIPTION
1,2	15 - 0	HEX	AA55	N/A	N/A	**START CHECKWORD**
3	7 - 0	BIN	0 - 23	HOURS	LSB = 1	**EFFECTIVE TIME HOURS**
4	7 - 0	BIN	0 - 59	MINUTES	LSB = 1	**EFFECTIVE TIME MINUTES**
5	7 - 0	BIN	0 - 59	SECONDS	LSB = 1	**EFFECTIVE TIME SECONDS**
6	7 - 0	BIN	0 - 255	SEC	1	**DURATION**
7,8	15 - 0	BIN	+/- 1 MHz	Hz	LSB = 1 kHz	**STEP SIZE**
9,10	15 - 0	HEX	55AA	N/A	N/A	**END CHECKWORD**

IR_FWD_DOPPLER_COMP_CONTROL_COMMAND

Description:

Type: Synchronous

This command provides the IR's Forward Model with the doppler compensation control information that is provided to the MDP. The Forward Model simulates the MDP by performing a linear frequency ramp for the duration specified in the duration field, to a target frequency specified by adding the Delta Target Frequency in the command to the current IF frequency at the effective time. At the end of the ramp, the Forward Model will either return or not return to profile, as specified by the Return To Profile parameter.

Command Verification:

PERFORMANCE REPORT

Upon initiation of the ramp in response to this command, the IR shall reflect this ramp by setting the FORWARD DOPPLER COMP CONTROL IN PROGRESS indicator in the FORWARD MODEL STATUS parameter. Upon completion of the ramp, the CARRIER COMPENSATION STATUS in the FORWARD MODEL STATUS parameter shall be set to either Following Profile or Holding Constant Frequency as appropriate.

Format:

IR_FORWARD_DOPPLER_COMP_CONTROL cont.

BYTE #	BIT # S	TYPE	RANGE	UNITS	RESOLUTION	DESCRIPTION
1 - 2	15 - 0	HEX	AA55	N/A	N/A	**START CHECKWORD**
3	7 - 0	BIN	0 - 23	HOURS	LSB = 1	**EFFECTIVE TIME HOURS**
4	7 - 0	BIN	0 - 59	MINUTES	LSB = 1	**EFFECTIVE TIME MINUTES**
5	7 - 0	BIN	0 - 59	SECONDS	LSB = 1	**EFFECTIVE TIME SECONDS**
6	7 - 0					**COMMAND WORD**
	0	BIN	0 or 1	N/A	N/A	1= RAMP CARRIER
	1					RESERVED for commonalty with MDP (RAMP PN - SHUTTLE ONLY)
	2 - 7					SPARES
7 - 8	15 - 0	BIN	0 to 600 (0 to 10 min)	SECONDS	1	**DURATION**
9 - 12	31 - 0	BIN	- 2M to +2M	Hz	0.01	**DELTA TARGET FREQUENCY**
13	7 - 0	N/A	N/A	N/A	N/A	**SPARE**
14	7 - 0	BIN	0 or 1	N/A	N/A	**RETURN TO PROFILE** At the end of the duration of an enable sweep, the use of the ephemeris table is resumed if and only if this parameter is "YES". 0 = NO 1 = YES
15 - 16	15 - 0	HEX	55AA	N/A	N/A	**END CHECKWORD**

IR_START_FORWARD_MODEL_COMMAND

Description:

Type: Synchronous

Description: Corresponds to the START_SERVICE_CMD provided to an associated MDP during coherent service, so that this can be simulated in the IR forward model. Start of this command shall reset all forward control commands in the forward model (such as IR_FORWARD_FREQUENCY_SWEEP_COMMAND, etc.). In addition, it shall cause the IR Forward Model to Enter the Forward Model Active State.

Command Verification:

PERFORMANCE REPORT

The FORWARD MODEL STATUS shall be set to Forward Model Active when the Forward Model is started.

Format:

BYTE #	BIT # S	TYPE	RANGE	UNITS	RESOLUTION	DESCRIPTION
1,2	15 - 0	HEX	AA55	N/A	N/A	**START CHECKWORD**
3	7 - 0	BIN	0 - 23	HOURS	LSB = 1	**EFFECTIVE TIME HOURS**
4	7 - 0	BIN	0 - 59	MINUTES	LSB = 1	**EFFECTIVE TIME MINUTES**
5	7 - 0	BIN	0 - 59	SECONDS	LSB = 1	**EFFECTIVE TIME SECONDS**
6	7 - 0	BIN	N/A	N/A	N/A	**SPARE**
7,8	15 - 0	HEX	55AA	N/A	N/A	**END CHECKWORD**

IR_COLD_START

Description:

Type: Synchronous

Supplies forward PN state and initiates forward model for tracking. This is used when the start - up of an IR cannot be synchronized with the start of an MDP in certain operational scenarios.

This command contains information on the state of the MDP at a time specified by SNAPSHOT TIME. The IR propagates this state, to start the Forward Model at the EFFECTIVE TIME. The difference between the EFFECTIVE TIME and the SNAPSHOT TIME shall not exceed 20 seconds. This command, like all other synchronous commands, shall be received by the IR at least one second in advance of the EFFECTIVE TIME. This command will not be sent to the IR while:

a. FORWARD SWEEP IN PROGRESS indicator in the FORWARD MODEL STATUS parameter is set.

b. FORWARD BREAK LOCK IN PROGRESS indicator in the FORWARD MODEL STATUS parameter is set.

c. FORWARD DOPPLER COMP CONTROL IN PROGRESS indicator in the FORWARD MODEL STATUS parameter is set.

Command Verification:

PERFORMANCE REPORT

COLD START shall be verified by setting the FORWARD MODEL STATUS to FORWARD MODEL ACTIVE, when the Forward Model has started.

Format:

BYTE #	BIT # S	TYPE	RANGE	UNITS	RESOLUTION	DESCRIPTION
1 - 2	15 - 0	HEX	AA55	N/A	N/A	**START CHECKWORD**
3	7 - 0	BIN	0 - 23	HOURS	LSB = 1	**EFFECTIVE TIME HOURS**
4	7 - 0	BIN	0 - 59	MINUTES	LSB = 1	**EFFECTIVE TIME MINUTES**
5	7 - 0	BIN	0 - 59	SECONDS	LSB = 1	**EFFECTIVE TIME SECONDS**
6	7 - 0	BIN	0 - 23	HOURS	LSB = 1	**SNAPSHOT TIME HOURS**
7	7 - 0	BIN	0 - 59	MINUTES	LSB = 1	**SNAPSHOT TIME MINUTES**
8	7 - 0	BIN	0 - 59	SECONDS	LSB = 1	**SNAPSHOT TIME SECONDS**
9 - 12	31 - 0	BIN	N/A	CHIPS	$\frac{M}{N * P * 400}$	**PN CODE STATE (MSB)**
13 - 16	31 - 0	BIN	N/A	CHIPS	$\frac{M}{N * P * 400}$	**PN CODE STATE (LSB)**
17 - 20	31 - 0	BIN	- 2 MHz to +2 MHz	Hz	.01	**IF CARRIER FREQUENCY** (Difference from 370 MHz)

NOTE: M=31, N=96, P=221 for SSA/MA Service Types
M=31, N=96, P=1469 for KSA Service Types
Value of PN code state is modulo code length.

BYTE #	BIT # S	TYPE	RANGE	UNITS	RESOLUTION	DESCRIPTION
21	7 - 0	BIN	0 OR 1	N/A	N/A	**CARRIER DOPPLER COMPENSATION STATE** 0 = Compensation Inhibited 1 = Compensation Active (Following profile)
22	7 - 0	BIN	0 OR 1	N/A	N/A	**SWEEP BIAS STATE** 0 = Bias Off 1 = Bias On
23 - 24	15 - 0	HEX	55AA	N/A	N/A	**END CHECKWORD**

F6.4 IR STATUS REPORTS

SUMMARY OF INTEGRATED RECEIVER (IR) STATUS TABLES:

IR_SPECIFIC_CONFIGURATION_REPORT

IR_COMMON_CONFIGURATION_REPORT

IR_TRACKING_REPORT

IR_EXTENDED_BIT_REPORT

IR_PERFORMANCE_REPORT

IR_SPECIFIC_CONFIGURATION_REPORT

Description: Reports configuration of the unit. The parameters of this report correspond to the parameters of the IR_SPECIFIC_CONFIGURATION_CMD.

Format:

BYTE #	BIT #S	TYPE	RANGE	UNITS	RESOLUTION	ACCURACY	DESCRIPTION
1,2	15 - 0	HEX	AA55	N/A	N/A	N/A	**START CHECKWORD**
3,4	15 - 0	BIN	1 - 366	DAYS	LSB = 1	CTFS	**REPORT TIME DAY**
5	7 - 0	BIN	0 - 23	HOURS	LSB = 1	CTFS	**REPORT TIME HOURS**
6	7 - 0	BIN	0 - 59	MINS	LSB = 1	CTFS	**REPORT TIME MIN– UTES**
7	7 - 0	BIN	0 - 59	SECS	LSB = 1	CTFS	**REPORT TIME SECONDS**
8	7 - 0	BIN	0 - 100	dB - Hz	LSB = 1	N/A	**REFERENCE C/N_0**

IR_SPECIFIC_CONFIGURATION_REPORT cont.

9	7 - 0	BIN	1 TO 29	N/A	N/A	N/A	**SERVICE TYPE** 1 = KSAR, DG - 1, MODE 1 or 3 2 = KSAR, DG - 1, MODE 2 3 = SPARE 4 = KSAR, DG - 2, MODE 1 5 = KSAR, DG - 2, MODE 2 6 = KSHR, MODE 1 7 = KSHR, MODE 2 8 = SSAR, DG - 1, MODE 1 or 3 9 = SSAR, DG - 1, MODE 2 10 = SPARE 11 = SSAR, DG - 2, MODE 1 12 = SSAR, DG - 2, MODE 2 13 = SSHR, MODE 1 OR 2 COHERENT 14 = SSHR, MODE 1 OR 2, NON - COHERENT 15 = SPARE 16 = SPARE 17 = SSHR, MODE 3 (COHERENT) 18 = MAR, DG - 1, MODE 1 19 = MAR, DG - 1, MODE 2 20 = RESERVED(KSAF) 21 = RESERVED(KSHF) 22 = RESERVED(SSAF) 23= RESERVED(SSHF) 24 = SPARE 25 = RESERVED(MAF) 26 = MA CALIBRATION 27= KSA RANGE ZERO SET 28 = SSA RANGE ZERO SET 29 = MA RANGE ZERO SET
10	7 - 0	BIN	1 TO 3	N/A	N/A	N/A	**SERVICE MODE** 1 = MODE 1 2 = MODE 2 (SSHR ONLY) 3 = MODE 3 (DG - 1 ONLY)

IR_SPECIFIC_CONFIGURATION_REPORT cont.

BYTE #	BIT #S	TYPE	RANGE	UNITS	RESOLUTION	ACCURACY	DESCRIPTION
11	7 - 0	BIN					**SETUP MISCELLANEOUS PARAMETERS**
	0		0 OR 1	N/A	N/A	N/A	SSA COMBINING ENABLE FOR SSAR AND SSHR: 1 = COMBINING ON
	1		0 OR 1	N/A	N/A	N/A	SSA DEINTERLEAVING I: 1 = ON 0 = OFF
	2		0 OR 1	N/A	N/A	N/A	SSA DEINTERLEAVING Q: 1 = ON 0 = OFF
	3						SPARE
	4		0 OR 1	N/A	N/A	N/A	I DECODING G2 INVERSION 1 = INVERTED 0 = NOT INVERTED
	5						Q DECODING G2 INVERSION 1 = INVERTED 2 = NOT INVERTED
	6 - 7						SPARE
12	7 - 0	BIN	- 6 dB to 0 dB or + 6 dB	dB	LSB = 0.1	N/A	**I/Q POWER RATIO, SINGLE/DUAL CHANNEL MODULATION = 1—6** - OR - **MODULATION INDEX, SINGLE/DUAL CHANNEL MODULATION = 7—9**
			0.2 TO 1.5, OR 0	RADIANS	LSB = 0.1		
13	7 - 0	BIN	1 TO 6	N/A	N/A	N/A	**I DATA FORMAT** 1 = NRZ - L 2 = NRZ - M 3 = NRZ - S 4 = BIPhase - L 5 = BIPhase - M 6 = BIPhase - S
14	7 - 0	BIN	1 TO 6	N/A	N/A	N/A	**Q DATA FORMAT** 1 = NRZ - L 2 = NRZ - M 3 = NRZ - S 4 = BIPhase - L 5 = BIPhase - M 6 = BIPhase - S

IR_SPECIFIC_CONFIGURATION_REPORT cont.

BYTE #	BIT #S	TYPE	RANGE	UNITS	RESOLUTION	ACCURACY	DESCRIPTION
15	7 - 0	BIN	1 TO 5 N/A	N/A	N/A	N/A	**I ENCODING** 1 = UNCODED (Decoder Bypass for SSA) 2 = CODE 1 (R=1/2) 3 = CODE 2 (R=1/2) 4 = CODE 3 (R=1/3) 5 = CODE 4 (R=1/3) (SHUTTLE MODE) This is not configured, but is reported for shuttle mode
16	7 - 0	BIN	1 TO 5 N/A	N/A	N/A	N/A	**Q ENCODING** 1 = UNCODED (Decoder Bypass for SSA) 2 = CODE 1 (R=1/2) 3 = CODE 2 (R=1/2) 4 = CODE 3 (R=1/3) 5 = CODE 4 (R=1/3, SHUTTLE)
17	7 - 0	BIN INT	1 TO 2	N/A	N/A	N/A	**I SYMBOL FORMAT** 1 = NRZ 2 = BIPHASE
18	7 - 0	BIN INT	1 TO 2	N/A	N/A	N/A	**Q SYMBOL FORMAT** 1 = NRZ 2 = BIPHASE
19	7 - 0	BIN	1 TO 3	N/A	N/A	N/A	**OPERATIONAL LIGHT** State of front panel light. 1 = ONLINE 2 = STANDBY 3 = MAINTENANCE

IR_SPECIFIC_CONFIGURATION_REPORT cont.

BYTE #	BIT #S	TYPE	RANGE	UNITS	RESOLUTION	ACCURACY	DESCRIPTION
20	7 - 0	BIN	1 TO 9	N/A	N/A	N/A	**SINGLE/DUAL CHANNEL MODULATION** 1 = I CHANNEL BPSK 2 = Q CHANNEL BPSK 3 = SINGLE CHANNEL DG - 1 QPSK 4 = SINGLE CHANNEL SQPSK ALT DATA BITS 5 = SINGLE CHANNEL SQPSK ALT CODED SYMBOLS 6 = DUAL CHANNEL QPSK 7 = SINGLE CHANNEL PM 8 = SINGLE CHANNEL SINEWAVE SUBCARRIER 9 = SINGLE CHANNEL SQUAREWAVE SUBCARRIER
21 - 24	31 - 0	BIN	100 TO 300 MBPS	BPS	LSB = 1	N/A	**I DATA RATE**
25 - 28	31 - 0	BIN	100 TO 150,000,000	BPS	LSB = 1	N/A	**Q DATA RATE, SINGLE/ DUAL CHANNEL MODULATION = 1—6**
							- OR -
			25,000 TO 3,000,000	Hz	LSB = 1	N/A	**SUBCARRIER FREQUENCY, SINGLE/DUAL CHANNEL MODULATION = 8—9**
29 - 32	31 - 0						**RETURN LINK MODE 1 AND 3 FEEDBACK TAPS**
	20 - 0	OCT	1000000 TO 1777777	N/A	N/A	N/A	21 Bit tap value Not used for Q channel in mode 3.
	31 - 21	BIN	0	N/A	N/A	N/A	Zero Pad
33 - 34	15 - 0						**INITIAL A REGISTER VALUE**
	10 - 0	OCT	0001 TO 3777	N/A	N/A	N/A	11 bit initial value
	15 - 11	BIN	0	N/A	N/A	N/A	Zero Pad
35 - 36	15 - 0						**INITIAL C REGISTER VALUE**
	10 - 0	OCT	0001 TO 3777	N/A	N/A	N/A	11 bit initial value
	15 - 11	BIN	0	N/A	N/A	N/A	Zero Pad
37 - 38	15 - 0	BIN	0 - 300	NSEC	LSB = 1	N/A	**SSA COMBINING DELAY**

IR_SPECIFIC_CONFIGURATION_REPORT cont.

BYTE #	BIT #S	TYPE	RANGE	UNITS	RESOLUTION	ACCURACY	DESCRIPTION
39	7 - 0	BIN	0 TO 3	N/A	N/A	N/A	**I SYMBOL JITTER** 0 = NONE 1 = 0.01% 2 = 0.1% 3 = 2.0%
40	7 - 0	BIN	0 TO 3	N/A	N/A	N/A	**Q SYMBOL JITTER** 0 = NONE 1 = 0.01% 2 = 0.1% 3 = 2.0%
41 - 44	31 - 0	BIN	- 2 MHz to + 2 MHz	HZ	LSB = 1 Hz	N/A	**RETURN IF OFFSET FREQUENCY, df_R**
45	7 - 0	BIN	0 OR 1	N/A	N/A	N/A	**KSAR I—CHANNEL DATA RECOVERY** 0 = DATA RECOVERY NOT REQUIRED 1 = DATA RECOVERY REQUIRED
46	7 - 0	BIN	0 OR 1	N/A	N/A	N/A	**KSAR Q—CHANNEL DATA RECOVERY** 0 = DATA RECOVERY NOT REQUIRED 1 = DATA RECOVERY REQUIRED
47 - 50	31 - 0	BIN	0 MHz to - 14000 MHz	Hz	LSB = 1kHz	N/A	**STGT RETURN TRANS—LATION FREQ, f_{trg}** Specifies the frequency translation of the STGT downconverters.
51 - 54	31 - 0	BIN	- 2500 MHz to +11500 MHz	Hz	LSB = 1 kHz	N/A	**TDRS RETURN TRANS—LATION FREQ, f_{trt}** Specifies the return frequency translation through the TDRS.
55 - 58	31 - 0	BIN	100 BPS to 300 MPBS	BPS	LSB=1	N/A	**SERVICE MAX I DATA RATE**
59 - 62	31 - 0	BIN	100 BPS to 150 MBPS	BPS	LSB=1	N/A	**SERVICE MAX Q DATA RATE**
63 - 64	15 - 0	HEX	55AA	N/A	N/A	N/A	**END CHECKWORD**

IR_COMMON_CONFIGURATION_REPORT

Description: Reports configuration of the unit. The parameters of this report correspond to the parameters of the IR_COMMON_CONFIG_CMD.

Format:

BYTE #	BIT #S	TYPE	RANGE	UNITS	RESOLUTION	ACCURACY	DESCRIPTION
1,2	15 - 0	HEX	AA55	N/A	N/A	N/A	**START CHECKWORD**
3,4	15 - 0	BIN	1 - 366	DAYS	LSB = 1	CTFS	**REPORT TIME DAY**
5	7 - 0	BIN	0 - 23	HOURS	LSB = 1	CTFS	**REPORT TIME HOURS**
6	7 - 0	BIN	0 - 59	MINS	LSB = 1	CTFS	**REPORT TIME MINUTES**
7	7 - 0	BIN	0 - 59	SECS	LSB = 1	CTFS	**REPORT TIME SECONDS**
8	7 - 0	BIN	N/A	N/A	N/A	N/A	**SPARE**
9 - 12	31 - 0	BIN	- 2MHz	HZ	LSB = 1 Hz	N/A	**FORWARD IF OFFSET FREQUENCY, df_F**
			to + 2 MHz				Delta Offset from 370 MHz
13 - 16	31 - 0	BIN	1000 MHz to 13500 MHz	Hz	LSB=1kHz	N/A	**FORWARD TRANSLATION FREQUENCY, f_{tf}**
17	7 - 0						**RESERVED (FORWARD PN MODULATION CONFIGURATION)**
18	7 - 0	BIN					**FORWARD DOPPLER COMPENSATION CONFIGURATION**
	0		0 OR 1	N/A	N/A	N/A	1 = FORWARD CARRIER DOPPLER COMP ACTIVE
	1						RESERVED (FWD PN RATE DOPPLER COMP)
	2 - 7						SPARE
19	7 - 0	BIN	1 OR 2	N/A	N/A	N/A	**GN/SN FORWARD SWEEP SELECT** 1 = SN SWEEP 2 = GN SWEEP
20	7 - 0	BIN	1 TO 120	SECS	LSB = 1	N/A	**FORWARD SWEEP DURATION**
21, 22	15 - 0	BIN	10 TO 600,000	Hz	LSB = 10	N/A	**FORWARD SWEEP RANGE**
23 - 24	15 - 0	HEX	55AA	N/A	N/A	N/A	**END CHECKWORD**

IR_TRACKING_REPORT

Description: Provides doppler and ranging and time transfer measurements for tracking services.

Format:

BYTE #	BIT #S	TYPE	RANGE	UNITS	RESOLUTION	ACCURACY	DESCRIPTION
1,2	15 - 0	HEX	AA55	N/A	N/A	N/A	**START CHECKWORD**
3,4	15 - 0	BIN	1 - 366	DAYS	LSB = 1	CTFS	**REPORT TIME DAY**
5	7 - 0	BIN	0 - 23	HOURS	LSB = 1	CTFS	**REPORT TIME HOURS**
6	7 - 0	BIN	0 - 59	MINS	LSB = 1	CTFS	**REPORT TIME MINUTES**
7	7 - 0	BIN	0 - 59	SECS	LSB = 1	CTFS	**REPORT TIME SECONDS**
8	7 - 0	BIN					**LOCK STATUS**
	0		0 OR 1	N/A	N/A	N/A	1 = PN LOCK
	1		0 OR 1	N/A	N/A	N/A	1 = I SYMBOL SYNC
	2		0 OR 1	N/A	N/A	N/A	1 = Q SYMBOL SYNC
	3		0 OR 1	N/A	N/A	N/A	1 = I DECODER LOCK
	4		0 OR 1	N/A	N/A	N/A	1 = Q DECODER LOCK
	5		0 OR 1	N/A	N/A	N/A	1 = MAIN CARRIER LOCK
	6		0 OR 1	N/A	N/A	N/A	1 = SUB CARRIER LOCK
	7						SPARE
9 - 12	31 - 0	BIN	- 1 TO 1 SEC	NSEC	LSB = 1	16 ns for DR <1K BPS 8ns for >= 1k BPS	**RANGE DELAY** This parameter is not an integrated measurement. It is a snapshot at the 1 pps.
13 - 16	31 - 0	BIN	- 2M to +2M	Cycles	LSB =1 Millicycle (0.001 cycle)		**1—SECOND AVERAGE DOPPLER** Reports integrated doppler count from t_0 - 1 to t_0 . Reports a zero (0) for the report time equal to the effective time of a time of a ZERO DOPPLER COUNT COMMAND

Accuracy: SSA / MA - DR<500 BPS ACC=0.05 Hz, 500<=DR<1000 ACC = 0.038 Hz,
DR>=1000 ACC = 0.025 Hz
KSA - DR>= 1000 BPS ACC= 0.025 Hz

IR_TRACKING_REPORT cont.

BYTE #	BIT #S	TYPE	RANGE	UNITS	RESOLUTION	ACCURACY	DESCRIPTION
							Time Transfer
17 - 20	31 - 0	BIN	0 TO 10^9	nSEC	LSB= 100	10 nsec systematic	**RETURN 1ST EPOCH MEASUREMENT** Measurement of first PN epoch relative to the 1 pps preceding the report time
21 - 24	31 - 0	BIN	0 TO 10^9	nSEC	LSB= 100	10 nsec systematic	**RETURN 2ND EPOCH MEASUREMENT** Measurement of second PN epoch relative to the 1 pps preceding the report time
25 - 28	31 - 0	BIN	- 9 SEC to +9 SEC	SEC	LSB = 0.5	.25 SEC	**TIME BIAS ESTIMATE** Provides time bias estimate. This is a snapshot measurement at the 1 pps. This is the time bias used for computation of integrated doppler frequency during a 2 - way, compensated, non - ranging tracking service.
29,30	15 - 0	HEX	55AA	N/A	N/A	N/A	**END CHECKWORD**

IR_PERFORMANCE_REPORT

Description: Provides performance status.

Format:

BYTE #	BIT #S	TYPE	RANGE	UNITS	RESOLUTION	ACCURACY	DESCRIPTION
1,2	15 - 0	HEX	AA55	N/A	N/A	N/A	**START CHECKWORD**
3,4	15 - 0	BIN	1 - 366	DAYS	LSB = 1	CTFS	**REPORT TIME DAY**
5	7 - 0	BIN	0 - 23	HOURS	LSB = 1	CTFS	**REPORT TIME HOURS**
6	7 - 0	BIN	0 - 59	MINS	LSB = 1	CTFS	**REPORT TIME MINUTES**
7	7 - 0	BIN	0 - 59	SECS	LSB = 1	CTFS	**REPORT TIME SECONDS**
8	7 - 0	BIN	0 OR 1	N/A	N/A	N/A	**LOCK STATUS**
	0		0 OR 1				1 = PN LOCK
	1		0 OR 1				1 = I SYMBOL SYNC
	2		0 OR 1				1 = Q SYMBOL SYNC
	3		0 OR 1				1 = I DECODER LOCK
	4		0 OR 1				1 = Q DECODER LOCK
	5		0 OR 1				1 = MAIN CARRIER LOCK
	6		0 OR 1				1 = SUB CARRIER LOCK
	7		0 OR 1				SPARE

IR_PERFORMANCE_REPORT cont.

BYTE #	BIT #S	TYPE	RANGE	UNITS	RESOLUTION	ACCURACY	DESCRIPTION
9 - 12	31 - 0	BIN					**COMMANDS NOT EXECUTED MAP**

Indicates commands not executed at specified time of execution that were suppose to execute in the previous second. These bit numbers map to the subaddress of the commands for the IR, MDP, or PTE. RESERVED indicates that a command type for another unit uses that subaddress.

0					RESERVED
1	0 or 1	N/A	N/A	N/A	SET STATE
2	0 or 1	N/A	N/A	N/A	COMMON CONFIGURATION
3	0 or 1	N/A	N/A	N/A	SPECIFIC CONFIGURATION
4					RESERVED
5	0 or 1	N/A	N/A	N/A	COLD START
6	0 or 1	N/A	N/A	N/A	FORWARD BREAK LOCK
7	0 or 1	N/A	N/A	N/A	DOWNLOAD
8	0 or 1	N/A	N/A	N/A	FORWARD FREQUENCY SWEEP
9	0 or 1	N/A	N/A	N/A	START ACQUISITION
10					RESERVED
11	0 or 1	N/A	N/A	N/A	FORWARD DOPPLER COMP CONTROL
12					RESERVED
13					RESERVED
14	0 or 1	N/A	N/A	N/A	START FORWARD MODEL
15					RESERVED
16	0 or 1	N/A	N/A	N/A	ZERO DOPPLER COUNT
17	0 or 1	N/A	N/A	N/A	EXPANDED FREQUENCY SEARCH
18	0 or 1	N/A	N/A	N/A	BURN ALERT
19					RESERVED
20	0 OR 1	N/A	N/A	N/A	EPHEMERIS DATA
21 - 31					RESERVED

IR_PERFORMANCE_REPORT cont.

BYTE #	BIT #S	TYPE	RANGE	UNITS	RESOLUTION	ACCURACY	DESCRIPTION
13 - 16	31 - 0	BIN					**COMMANDS NOT ACCEPTED MAP**
Indicates commands which were immediately rejected within the past second. These bit numbers map to the subaddress of the commands for the IR, MDP, or PTE. RESERVED indicates that a command type for another unit uses that subaddress.							
	0						RESERVED
	1		0 or 1	N/A	N/A	N/A	SET STATE
	2		0 or 1	N/A	N/A	N/A	COMMON CONFIGURATION
	3		0 or 1	N/A	N/A	N/A	SPECIFIC CONFIGURATION
	4						RESERVED
	5		0 or 1	N/A	N/A	N/A	COLD START
	6		0 or 1	N/A	N/A	N/A	FORWARD BREAK LOCK
	7		0 or 1	N/A	N/A	N/A	DOWNLOAD
	8		0 or 1	N/A	N/A	N/A	FORWARD FREQUENCY SWEEP
	9		0 or 1	N/A	N/A	N/A	START ACQUISITION
	10						RESERVED
	11		0 or 1	N/A	N/A	N/A	FORWARD DOPPLER COMP CONTROL
	12						RESERVED
	13						RESERVED
	14		0 or 1	N/A	N/A	N/A	START FORWARD MODEL
	15						RESERVED
	16		0 or 1	N/A	N/A	N/A	ZERO DOPPLER COUNT
	17		0 or 1	N/A	N/A	N/A	EXPANDED FREQUENCY SEARCH
	18		0 or 1	N/A	N/A	N/A	BURN ALERT
	19						RESERVED
	20		0 or 1	N/A	N/A	N/A	EPHEMERIS DATA
	21 - 31						RESERVED

IR_PERFORMANCE_REPORT cont.

BYTE #	BIT #S	TYPE	RANGE	UNITS	RESOLUTION	ACCURACY	DESCRIPTION
17	7 - 0	BIN	0 - 2	N/A	N/A	N/A	**COMMAND NOT EXECUTED ERROR CODE** REPORTS REASON WHY THE LAST COMMAND NOT EXECUTED WAS NOT EXECUTED. 0 = NO ERROR 1 = ILLEGAL STATE The commands initiation time was during a state not allowed in accordance with the state table. 2 = ALREADY IN PROGRESS A commands initiation time was during the execution time of the same command sent previously.
18	7 - 0	BIN	0 - 8	N/A	N/A	N/A	**COMMAND NOT ACCEPTED ERROR CODE** REPORTS REASON WHY THE LAST COMMAND NOT ACCEPTED WAS NOT ACCEPTED 0 = NO ERROR 1 = INSUFFICIENT NOTIFI - CATION Synchronous command received too close to effective time 2 = EFFECTIVE TIME IN PAST Synchronous command was received after effective time. 3 = INVALID SUBADDRESS 4 = INCORRECT COMMAND SIZE 5 = INCOMPLETE CONFI - GURATION (Indicates that the configuration data needed was not supplied to execute the last command) 6 = INCORRECT EPHEMER - IS TABLE SIZE (More than 10 minutes of data) 7 = Effective time greater than 60 minutes in future 8 = Ephemeris protocol error

IR_PERFORMANCE_REPORT cont.

BYTE #	BIT #S	TYPE	RANGE	UNITS	RESOLUTION	ACCURACY	DESCRIPTION
19	7 - 0						**SPARE**
20	7 - 0	BIN	1 TO 7	N/A	N/A	N/A	**OPERATING STATE** 1 = STANDBY 2 = EXTENDED BIT 3 = CONFIGURED 4 = CONFIG IN PROGRESS 5 = ACQUISITION 6 = TRACK 7 = REACQUISITION
21 - 22	15 - 0	BIN	0 - 2	N/A	N/A	N/A	**I COHERENT DATA AGC STATUS** 0 = LEVEL LOW 1 = LEVEL OK 2 = LEVEL HIGH
23 - 24	15 - 0	BIN	0 - 2	N/A	N/A	N/A	**Q COHERENT DATA AGC STATUS** 0 = LEVEL LOW 1 = LEVEL OK 2 = LEVEL HIGH
25 - 26	15 - 0	BIN	0 - 2	N/A	N/A	N/A	**370 MHz IF AGC STATUS** 0 = LEVEL LOW 1 = LEVEL OK 2 = LEVEL HIGH
27 - 28	15 - 0	BIN	0 - 2	N/A	N/A	N/A	**8.5 MHz IF AGC STATUS** 0 = LEVEL LOW 1 = LEVEL OK 2 = LEVEL HIGH
29	7 - 0	BIN	0 OR 1	N/A	N/A	N/A	**EPHEMERIS STATUS**
	0						SPARE
	1						1 = UPDATE COMPLETE
	2 - 7						SPARE

IR_PERFORMANCE_REPORT cont.

BYTE #	BIT #S	TYPE	RANGE	UNITS	RESOLUTION	ACCURACY	DESCRIPTION
30	7 - 0	N/A	N/A	N/A	N/A	N/A	**SPARE**
31	7 - 0	BIN					**FORWARD MODEL STATUS**
	0		0 OR 1	N/A	N/A	N/A	1 = FORWARD MODEL ACTIVE (Started either by START_FWD_ MODEL_CMD or COLD_START)
	1		0 OR 1	N/A	N/A	N/A	1= FORWARD BREAK LOCK IN PROGRESS
	2		0 OR 1	N/A	N/A	N/A	1 = FORWARD SWEEP IN PROGRESS
	3		0 OR 1	N/A	N/A	N/A	1 = FORWARD DOPPLER COMP CONTROL IN PROGRESS
	4		0 OR 1	N/A	N/A	N/A	CARRIER COMPEN - SATION STATUS 0 = HOLDING CONSTANT FREQUENCY 1 = FOLLOWING PROFILE
	5		0 OR 1	N/A	N/A	N/A	FORWARD MODEL SWEEP BIAS 0 = BIAS OFF 1 = BIAS ON
	6 - 7						SPARES
32	7 - 0	BIN					**RECEIVER CONTROL STATUS**
	0		0 OR 1	N/A	N/A	N/A	1 = EXPANDED FREQUENCY OR PN SEARCH IN EFFECT
	1		0 OR 1	N/A	N/A	N/A	1 = BURN ALERT IN PROGRESS
	2 - 7						SPARES
33 - 34	15 - 0	BIN	- 45 to +65	dB	LSB=0.1	0.5	**E_b/N_o ESTIMATE — I CHANNEL** ODM DATA - This measure - ment is integrated over each 1 second period by MCP. Collected every 10 ms. IR is accurate in the range 2 to 12.

IR_PERFORMANCE_REPORT cont.

BYTE #	BIT #S	TYPE	RANGE	UNITS	RESOLUTION	ACCURACY	DESCRIPTION
35 - 36	15 - 0	BIN	- 45 to +65	dB	LSB=0.1	0.5	**E_b/N_o ESTIMATE — Q CHANNEL** ODM DATA This measurement is integrated over each 1 second period by MCP. Collected every 10 ms. IR is accurate in the range 2 - 12.
37 - 40	31 - 0	BIN	0 - 12M	# Symbols		1	1 **I SYMBOL ERROR COUNT** Destructive count over 1 sec ODM DATA
41 - 44	31 - 0	BIN	0 - 6M	# Symbols		1	1 **Q SYMBOL ERROR COUNT** Destructive count over 1 sec ODM DATA
45 - 46	15 - 0	BIN	0 TO 60000 (0 TO 1 MIN)	mSEC	LSB=1 msec	20 msec	**I CHANNEL LOCK TIME** Measured from time unit attempts to acquire after receipt of a START ACQ.
47 - 48	15 - 0	BIN	0 TO 60000 (0 TO 1 MIN)	mSEC	LSB=1 msec	20 msec	**Q CHANNEL LOCK TIME** Measured from time unit attempts to acquire after receipt of a START ACQ.

IR_PERFORMANCE_REPORT cont.

BYTE #	BIT #S	TYPE	RANGE	UNITS	RESOLUTION	ACCURACY	DESCRIPTION
49 - 52	31 - 0	BIN		N/A	N/A	N/A	**CONFIDENCE TEST RESULTS BY LRU** Reports status of an LRUs as a result of confidence testing. Refer to F3.2.5 for applicable LRUs.
	0		0 or 1				1 = MCP LRU SUSPECT
	1		0 or 1				1 = ACQ LRU SUSPECT
	2		0 or 1				1 = PNP LRU SUSPECT
	3		0 or 1				1 = TIME LRU SUSPECT
	4		0 or 1				1 = DMDP LRU SUSPECT
	5		0 or 1				1 = OUTP LRU SUSPECT
	6		0 or 1				1 = DMSS (Q) LRU SUSPECT
	7		0 or 1				1 = RFDC2 LRU SUSPECT
	8		0 or 1				1 = SYNTH LRU SUSPECT
	9		0 or 1				1 = DMSS (I) LRU SUSPECT
	10		0 or 1				1 = RFDC1 LRU SUSPECT
	11		0 or 1				1 = 5V (PS1 / PS2) LRU SUSPECT
	12		0 or 1				1 = RF5V (PS1) LRU SUSPECT
	13		0 or 1				1 = 12 V (PS2) LRU SUSPECT
	14		0 or 1				1 = 15V (PS1) LRU SUSPECT
	15		0 or 1				1 = HIGH UNIT TEMPERA - TURE
	16		0 or 1				1 = HRDC LRU SUSPECT
	17 - 29		0 or 1				SPARES
	30		0 or 1				1 = TEST COMPLETE
	31		0 or 1				1 = TEST FAILED

IR_PERFORMANCE_REPORT cont.

BYTE #	BIT #S	TYPE	RANGE	UNITS	RESOLUTION	ACCURACY	DESCRIPTION
53 - 56	31 - 0	BIN	0 or 1 per bit	N/A	N/A	N/A	**ONLINE BIT STATUS BY LRU** Reports status of an LRU as a result of ONLINE BIT Refer to F3.2.5 for applicable LRUs.
	0		0 or 1				1 = MCP LRU SUSPECT
	1		0 or 1				1 = ACQ LRU SUSPECT
	2		0 or 1				1 = PNP LRU SUSPECT
	3		0 or 1				1 = TIME LRU SUSPECT
	4		0 or 1				1 = DMDP LRU SUSPECT
	5		0 or 1				1 = OUTP LRU SUSPECT
	6		0 or 1				1 = DMSS (Q) LRU SUSPECT
	7		0 or 1				1 = RFDC2 LRU SUSPECT
8		0 or 1				1 = SYNTH LRU	SUSPECT
	9		0 or 1				1 = DMSS (I) LRU SUSPECT
	10		0 or 1				1 = RFDC1 LRU SUSPECT
	11		0 or 1				1 = 5V (PS1 / PS2) LRU SUSPECT
	12		0 or 1				1 = RF5V (PS1) LRU SUSPECT
	13		0 or 1				1 = 12 V (PS2) LRU SUSPECT
	14		0 or 1				1 = 15V (PS1) LRU SUSPECT
	15		0 or 1				1 = HIGH UNIT TEM-
PERA -							TURE
	16		0 or 1				1 = HRDC LRU SUSPECT
	17 - 29		0 or 1				SPARES
	30		0 or 1				1 = ON - LINE STATUS VALID
	31		0 or 1				1 = TEST FAILED
57	7 - 0	BIN	0 or 1	N/A	N/A	N/A	**LOCAL / REMOTE** 0 = REMOTE 1 = LOCAL
58	0	BIN	0 or 1	N/A	N/A	N/A	**HRDC PRESENCE** 1 = PRESENT
	1 - 7	N/A	N/A	N/A	N/A	N/A	**SPARE**
59 - 60	15 - 0	HEX	55AA	N/A	N/A	N/A	**END CHECKWORD**

IR_EXTENDED_BIT_REPORT

Description: Reports results of Extended BIT. Specified as LRUs failed by test. Refer to F3.2.5 for Extended BIT descriptions, including LRUs used in each test.

Format:

BYTE #	BIT #S	TYPE	RANGE	UNITS	RESOLUTION	ACCURACY	DESCRIPTION
1,2	15 - 0	HEX	AA55	N/A	N/A	N/A	**START CHECKWORD**
3,4	15 - 0	BIN	1 - 366	DAYS	LSB = 1	CTFS	**EXTENDED BIT COMPLETION TIME DAY**
5	7 - 0	BIN	0 - 23	HOURS	LSB = 1	CTFS	**EXTENDED BIT COMPLETION TIME HOURS**
6	7 - 0	BIN	0 - 59	MINS	LSB = 1	CTFS	**EXTENDED BIT COMPLETION TIME MINUTES**
7	7 - 0	BIN	0 - 59	SECS	LSB = 1	CTFS	**EXTENDED BIT COMPLETION TIME SECONDS**
8	7 - 0	N/A	N/A	N/A	N/A	N/A	**SPARE**
9 - 12	31 - 0	BIN	0 or 1 per bit	N/A	N/A	N/A	**TEST RESULTS** Reports LRUs suspect as a result of extended BIT.
	0		0 or 1				1 = MCP LRU SUSPECT
	1		0 or 1				1 = ACQ LRU SUSPECT
	2		0 or 1				1 = PNP LRU SUSPECT
	3		0 or 1				1 = TIME LRU SUSPECT
	4		0 or 1				1 = DMDP LRU SUSPECT
	5		0 or 1				1 = OUTP LRU SUSPECT
	6		0 or 1				1 = DMSS (Q) LRU SUSPECT
	7		0 or 1				1 = RFDC2 LRU SUSPECT
	8		0 or 1				1 = SYNTH LRU SUSPECT
	9		0 or 1				1 = DMSS (I) LRU SUSPECT
	10		0 or 1				1 = RFDC1 LRU SUSPECT
	11		0 or 1				1 = 5V (PS1 / PS2) LRU SUSPECT
	12		0 or 1				1 = RF5V (PS1) LRU SUSPECT
	13		0 or 1				1 = 12 V (PS2) LRU SUSPECT
	14		0 or 1				1 = 15V (PS1) LRU SUSPECT
	15		0 or 1				1= HIGH UNIT TEMPERA - TURE
	16		0 or 1				1 = HRDC LRU SUSPECT
	17 - 29		0 or 1				SPARES
	30		0 or 1				1 = TEST COMPLETE
	31		0 or 1				1 = TEST FAILED

IR_EXTENDED_BIT_REPORT cont.

BYTE #	BIT #S	TYPE	RANGE	UNITS	RESOLUTION	ACCURACY	DESCRIPTION
13 - 16	31 - 0	BIN	0 or 1 per bit	N/A	N/A	N/A	**VME TEST RESULTS BY LRU** Reports LRU suspects as a re - sult of the VME test.
			(Refer to MCP TEST RESULTS BY LRU for LRU bit map)				
17 - 20	31 - 0	BIN	0 or 1 per bit	N/A	N/A	N/A	**TIME TEST RESULTS BY LRU** Reports LRU suspects as a re - sult of the TIME test.
			(Refer to MCP TEST RESULTS BY LRU for LRU bit map)				
21 - 24	31 - 0	BIN	0 or 1 per bit	N/A	N/A	N/A	**DMDP TEST RESULTS BY LRU** Reports LRU suspects as a re - sult of the DMDP test.
			(Refer to MCP TEST RESULTS BY LRU for LRU bit map)				
25 - 28	31 - 0	BIN	0 or 1 per bit	N/A	N/A	N/A	**DEMOD ASIC I TEST RE— SULTS BY LRU** Reports LRU suspects as a re - sult of the DEMOD ASIC I test.
			(Refer to MCP TEST RESULTS BY LRU for LRU bit map)				
29 - 32	31 - 0	BIN	0 or 1 per bit	N/A	N/A	N/A	**DEMOD ASIC Q TEST RE— SULTS BY LRU** Reports LRU suspects as a re - sult of the DEMOD ASIC Q test.
			(Refer to MCP TEST RESULTS BY LRU for LRU bit map)				
33 - 36	31 - 0	BIN	0 or 1 per bit	N/A	N/A	N/A	**SIGNAL LEVEL TEST RE— SULTS BY LRU** Reports LRU suspects as a re - sult of the SIGNAL LEVEL test.
			(Refer to MCP TEST RESULTS BY LRU for LRU bit map)				
37 - 40	31 - 0	BIN	0 or 1 per bit	N/A	N/A	N/A	**PNP TEST RESULTS BY LRU** Reports LRU suspects as a re - sult of the PNP test.
			(Refer to MCP TEST RESULTS BY LRU for LRU bit map)				

IR_EXTENDED_BIT_REPORT cont.

BYTE #	BIT #S	TYPE	RANGE	UNITS	RESOLUTION	ACCURACY	DESCRIPTION
41 - 44	31 - 0	BIN	0 or 1 per bit	N/A	N/A	N/A	**CORR TAP TEST RESULTS BY LRU** Reports LRU suspects as a result of the CORR TAP test.

(Refer to MCP TEST RESULTS BY LRU for LRU bit map)

45 - 48	31 - 0	BIN	N/A	N/A	N/A	N/A	**SPARE**
49 - 52	31 - 0	BIN	N/A	N/A	N/A	N/A	**SPARE**
53 - 56	31 - 0	BIN	N/A	N/A	N/A	N/A	**SPARE**
57 - 60	31 - 0	BIN	N/A	N/A	N/A	N/A	**SPARE**
61 - 62	15 - 0	BIN	N/A	N/A	N/A	N/A	**SPARE**
63 - 64	15 - 0	HEX	55AA	N/A	N/A	N/A	**END CHECKWORD**

SECTION F7
END—TO—END COMMUNICATIONS CONTROL LEVEL

F7.1 GENERAL

This section describes the interactions of the End - to - End Communications Control Level of the IR - SSC/ADPE interface (interaction 3 of Figure F4 - 1).

F7.2 BLOCKING

Data shall be blocked in an even number byte format. No command (except ephemeris data) or report shall contain more than 64 bytes, so that it will fit into a single 1553 transfer. Each command and report shall begin with a START CHECKWORD of AA55 HEX, and end with an END CHECKWORD of 55AA HEX. Since each command is identified by its subaddress location in the IR, no command ID need be contained within the End - to - End data message.

F7.3 IR ILLEGAL COMMAND REPORTING

F7.3.1 SYNCHRONOUS COMMANDS

F7.3.1.1 Not Accepted

Synchronous commands shall be rejected via the COMMAND NOT ACCEPTED parameter in the PERFORMANCE REPORT if:

a. the command is received with insufficient setup time (insufficient notification) as specified in Table F5 - 1.

b. the command is received more than 1 hour in advance of the effective time.

c. the command contains an effective time in the past.

d. the command was received in an invalid subaddress

e. the command contained an incorrect block size (see blocking)

f. there was incomplete configuration data provided to execute that command.

F7.3.1.2 Not Executed

Synchronous commands shall be rejected via the COMMAND NOT EXECUTED parameter in the PERFORMANCE REPORT if:

a. the command 's EFFECTIVE TIME occurred during an unallowed state as specified by the IR COMMAND STATE TABLE, Table F5 - 2.

b. command execution of that command is already in progress at the effective time of the new command. Execution times are specified in Table F5 - 1.

Should the time between receiving commands of the same type be less than the setup time, the unit shall NOT lockup or malfunction. The unit may, however, overwrite the previous command. This shall not be reported.

F7.3.2 ASYNCHRONOUS COMMANDS

Asynchronous commands shall be rejected via the COMMAND NOT ACCEPTED or COMMAND NOT EXECUTED parameter in the PERFORMANCE REPORT if:

a. the command was received during an invalid state (Refer to Table F5 - 2 for valid states).

b. the command was received in an invalid subaddress

c. the command contained an incorrect block size (see blocking)

d. there was incomplete configuration data provided to execute that command.

e. ephemeris protocol error

f. incorrect ephemeris table size

F7.3.3 INVALID COMMAND PARAMETERS

Invalid Command Parameters (Out - of - Range value or undefined option selection) shall not cause a command to be rejected, nor shall it cause a unit malfunction. Instead, the command shall be executed using default parameter values for each invalid parameter received.

F7.4 INVALID REPORT TIME TAGS

In the case where the report time tags cease to increment (except EXTENDED BIT REPORT), the ADPE shall assume after two successive time tag failures, that the IR has had a CPU failure. The ADPE shall initiate a failover in response to this error.

SECTION F8
NETWORK/TRANSPORT CONTROL LEVEL

F8.1 GENERAL

This section describes the Network / Transport Control Level interactions of the IR - SSC/ADPE interface: IR - SSC and SSC - ADPE (interactions 4 and 5 of Figure F4 - 1).

F8.2 INTEGRATED RECEIVER — SUBSYSTEM CONTROLLER

F8.2.1 DATA BLOCK / BYTE MAP

All message formats (commands and status) are defined in bytes. The MSB is transmitted first in accordance with MIL - STD - 1553B. The message format of the bytes is such that the first to last parameter and the MSB to LSB is in the BYTE order of 1 to N respectively. The mapping of bytes No.'s to 1553 words is shown in Figure F8 - 1.

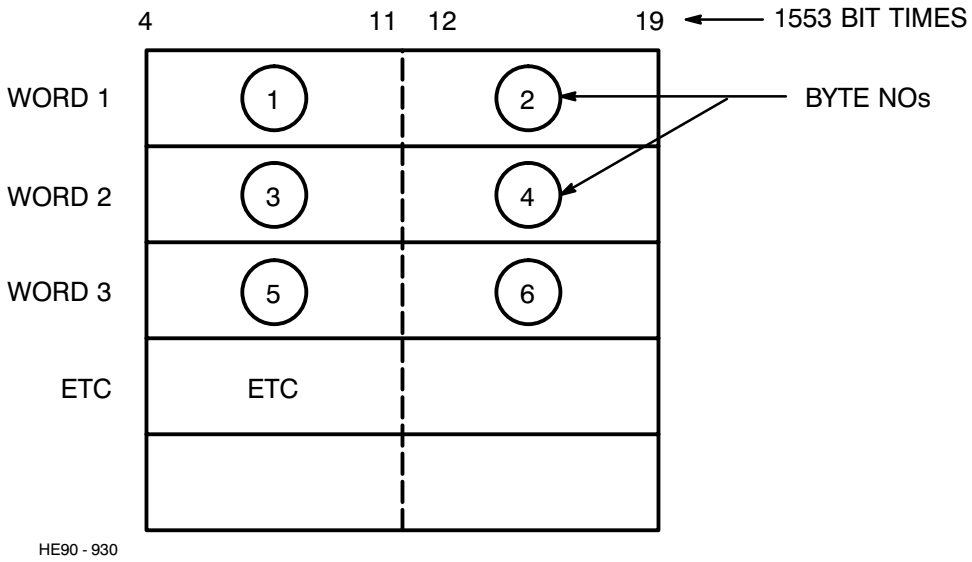


Figure F8—1. Data Transfers

As this is the exact blocking of the data being transmitted and received by the ADPE (excluding the applications header defined in HE - 06 - 1), the messages to and from the IR from the SSC shall be a direct pass through. Table F8 - 1 shows the IR command message block sizes. Table 8 - 2 shows the IR report message block sizes.

TABLE F8—1. IR COMMAND MESSAGE BLOCK SIZES

COMMAND	BLOCK SIZE (No. 1553 WORDS)
SET STATE	4
COMMON CONFIGURATION	10
SPECIFIC CONFIGURATION	32
COLD START	12
FORWARD BREAK LOCK	5
DOWNLOAD (EPHEMERIS | FIRMWARE)	6
FORWARD FREQUENCY SWEEP	4
START ACQUISITION	2
FORWARD DOPPLER COMP CONTROL	8
START FORWARD MODEL	4
ZERO DOPPLER COUNT	4
EXPANDED FREQUENCY SEARCH	2
BURN ALERT	4
EPHEMERIS DATA BLOCKS	6 + (No. points x No. tables x 2)

Max No. 1553 words = 9606

TABLE F8—2. IR REPORT MESSAGE BLOCK SIZES

REPORT	BLOCK SIZE (No. 1553 WORDS)
COMMON CONFIGURATION REPORT	10
SPECIFIC CONFIGURATION REPORT	32
TRACKING REPORT	15
PERFORMANCE REPORT	30
EXTENDED BIT REPORT	32

F8.2.2 1553 SUBADDRESSES

Subaddress values 0 or 31 shall indicate the presence of a mode code command in the Data Word Count/Mode Code field of the command word. Subaddress values 1 through 29 shall be available to identify Command and Report block messages, as described in the Commands and Reports paragraphs. The presence of an unused subaddress value shall cause the command word to be considered illegal. Illegal commands shall be processed as described in the Illegal Command Word paragraph.

F8.2.3 COMMAND SUBADDRESS IDENTIFICATION

Commands shall be identified by means of uniquely assigned MIL - STD - 1553 subaddresses, as per the Command Message Subaddress, Table F8 - 3. The remote terminals shall use the subaddress value within the received command word as an index to store each received message into a dedicated message buffer.

The subaddresses of the MIL - STD - 1553 messages comprising the download Ephemeris data block shall sequence through values of 20 through 29, in order, as required. The first message of a download data block shall have a subaddress of 20. The Download Command shall specify the download type (Ephemeris or Firmware) and word size of the ensuing download data block. Other Commands may be interspersed with the download data block messages. If the word size of the data block contains more words than can fit in subaddresses 20 - 29, then the block shall repeat subaddresses 20 through 29 sequentially. Each subaddress must be filled with 32 words prior to the loading of the next subaddress.

TABLE F8—3. COMMAND MESSAGE SUBADDRESSES

COMMAND	SUBADDRESS		
	IR	MDP	PTE
SET STATE	1	1	1
COMMON CONFIGURE (IR / MDP / PTE DEMOD)	2	2	2
SPECIFIC CONFIGURE (IR / PTE MOD)	3	N/A	3
SPECIFIC CONFIGURE (MDP / PTE DEMOD)	N/A	4	4
COLD START	5	N/A	N/A
FORWARD BREAK LOCK	6	6	N/A
DOWNLOAD (EPHEMERIS | FIRMWARE)	7	7	7
FORWARD FREQUENCY SWEEP	8	8	N/A
START ACQUISITION	9	N/A	9
START SERVICE	N/A	10	10
FORWARD DOPPLER COMP CONTROL	11	11	N/A
START FWD BER TEST	N/A	N/A	12
START RTN BER TEST	N/A	N/A	13
START FORWARD MODEL	14	N/A	14
MEASURE TIME INTERVAL	N/A	N/A	15
ZERO DOPPLER COUNT	16	N/A	N/A
EXPANDED FREQUENCY SEARCH	17	N/A	N/A
BURN ALERT	18	N/A	N/A
GENERAL CONFIGURE (PTE)	N/A	N/A	18
RANGE CHANNEL REACQUISITION	N/A	N/A	19
DOWNLOAD DATA BLOCKS	20 - 29		
RESERVED (DATA WRAP - AROUND)	30		
MODE CODE COMMANDS	0, 31		

F8.2.4 REPORT SUBADDRESS IDENTIFICATION

Reports shall be identified by means of uniquely assigned MIL - STD - 1553 subaddresses, as per the Report Message Subaddresses, Table F8 - 4. The SSC transmit command shall contain a subaddress that the remote terminals shall use as an index to select the desired Report message for transmission to the SSC.

TABLE F8—4. REPORT MESSAGE SUBADDRESSES

REPORT	SUBADDRESS		
	IR	MDP	PTE
TRACKING/TIME TRANSFER	1	1	N/A
SPECIFIC CONFIGURATION, MDP / PTE MOD	N/A	2	2
SPECIFIC CONFIGURATION, IR / PTE DEMOD	3	N/A	3
PERFORMANCE, IR / PTE DEMOD	4	N/A	4
PERFORMANCE, MDP / PTE MOD	N/A	5	5
EXTENDED BIT	6	6	6
PTE GENERAL REPORT	N/A	N/A	7
BER MEASUREMENTS	N/A	N/A	8
COMMON CONFIGURATION, MDP	N/A	9	N/A
COMMON CONFIGURATION, IR	10	N/A	N/A
SPARE	11 - 29		
RESERVED (DATA WRAP - AROUND)	30		

F8.2.5 IR POWER–UP INITIALIZATION

Upon power - up or reset, the IR will enter its Confidence Test In Progress State. During this state, there shall be a maximum of 10 seconds, where the IR does not respond over the 1553 bus.

F8.2.6 MESSAGE ERROR HANDLING

In response to a 1553 message error flag in the 1553 status word, the SSC shall retransmit the message to the IR one time. Should a second message error occur, the SSC shall report the error to the ADPE as described in paragraph F8.3.3.

F8.2.7 REMOTE TERMINAL ADDRESS

The IR RT address shall be determined via an external harness cable.

F8.2.8 STATUS COLLECTION

Upon receipt of the 1PPS epoch command from the ADPE, the SSC shall initiate a delay of 300 ms prior to collecting the IR status when IR tables have been selected by the ADPE. The status shall be collected within a 550 ms window following the delay, which will be reported to ADPE upon receipt of the next transmit status command. Figure F8 - 2 shows a timeline of the status collection process.

F8.3 SUBSYSTEM CONTROLLER – ADPE

F8.3.1 DATA BLOCK / BYTE MAP

The IR message blocks shall be transferred between the SSC and the ADPE as per paragraph F8.2.1. ADPE applications header (as per HE - 06 - 1) shall be stripped off of commands prior to sending to the IR. Status report blocks, when reported to the ADPE, shall be provided in a status table as described in HE - 06 - 1 paragraphs 6.1.1, 6.2.2, and 6.3.1 for SSA, MA, and KSA respectively.

F8.3.2 IR UNIT COMMAND ID PROCESSING

A unit command ID shall be passed to the SSC as part of the application header which shall indicate which command is being sent on to the IR. The SSC shall use this ID to determine the subaddress on the IR/SSC 1553 bus on which the command shall be transmitted. The unit command ID for each command shall be as defined in paragraph 6.1.1.13 of HE - 06 - 1. The mapping of command to subaddress is shown in Table F8 - 3.

F8.3.3 SSC – IR 1553 BUS MESSAGE ERROR REPORTING

Lack of IR bus response (due to problem or power - up) or receipt of message error after retry shall be reported to the ADPE via a once per second SSC status table, as defined in the Format Control Level of HE - 06 - 1, paragraphs 6.1.1.1, 6.2.1.1, and 6.3.1.1.

SECTION F9
LINK CONTROL LEVEL

F9.1 GENERAL

This section describes the Link Control Level interactions of the IR - SSC interface (interaction 6 of Figure F4 - 1).

F9.2 MODE CODES

Nine mode code commands shall be provided to support interface diagnostic procedures and dual redundant support. Table F 9 - 1 lists the supported mode codes.The mode code command processing shall conform to MIL - STD - 1553, as described below. The mode code command rate shall not exceed one per second.

TABLE F9—1. SUPPORTED MODE CODES

COMMAND	MODE CODES (BITS 15—19)
TRANSMIT STATUS WORD	00010 (2)
INITIATE SELF TEST	00011 (3)
TRANSMITTER SHUTDOWN	00100 (4)
OVERRIDE TRANSMITTER SHUTDOWN	00101 (5)
INHIBIT TERMINAL FLAG	00110 (6)
OVERRIDE INHIBIT TERMINAL FLAG	00111 (7)
RESET REMOTE TERMINAL	01000 (8)
TRANSMIT LAST COMMAND	10010 (18)
TRANSMIT BIT WORD	10011 (19)

The Transmit Bit command shall cause the remote terminal to transmit its status word followed by a single data word containing the remote terminal's BIT data. The data word, containing the remote terminal BIT data, shall not be altered by the reception of a transmit last command or a transmit status word mode code. The next status word access shall reflect any errors in BIT word transmission. The format of the remote terminal's BIT Word format shown in Table F9 - 2.

TABLE F9—2. REMOTE TERMINAL BIT WORD FORMAT

BIT	MEANING
15 (MSB)	LOGIC “0”
14	LOGIC “0”
13	CHANNEL B TRANSMITTER TIMEOUT
12	CHANNEL A TRANSMITTER TIMEOUT
11	CHANNEL B LOOP TEST FAILURE
10	CHANNEL A LOOP TEST FAILURE
9	CHANNEL B TRANSMITTER SHUTDOWN
8	CHANNEL A TRANSMITTER SHUTDOWN
7	NON - MODE BROADCAST COMMAND TO TRANSMIT
6	MESSAGE ABORT - HIGH WORD COUNT
5	MESSAGE ABORT - LOW WORD COUNT
4	ILLEGAL MODE CODE OR ILLEGAL BRDCST W/ MODE CODE
3	MODE CODE OR TRANSMIT/RECEIVE BIT ERROR
2	A/B LOOP TEST FAILURE
1	HANDSHAKE FAILURE
0 (LSB)	A/B TRANSMITTER FAILURE

F9.3 1553 STATUS WORD

The supported status bits are listed in Table F9 - 3 . The other status bits shall be spared, and their value not guaranteed.

TABLE F9—3. SUPPORTED STATUS BITS

STATUS BIT FUNCTION	STATUS BIT — TIMES
Message Error	9
Terminal Flag	19

F9.3.1 MESSAGE ERROR

The Message Error bit shall be set as per the 1553B standard to indicate that the preceding received bus controller message was in error. The validation criteria shall include those for invalid messages (data and command word validation, transmission continuity, and word count verification).

F9.3.2 TERMINAL FLAG

The Terminal Flag bit shall be set by the remote terminal when it detects a bit error during data transmission. This shall be accomplished by means of its loop - back data monitoring feature. During data transmission, the last word of each MIL - STD - 1553 message transmitted from the remote terminal shall be verified. The last word of each message shall be locally looped - back

through the receive circuitry of the remote terminal. The transmitted and 'received' copies of the message's last word shall be bit - by - bit compared to detect any transmission errors. If a transmission error is detected, the remote terminal shall set the Terminal Flag bit in its status word.

F9.3.3 1553 RECEPTION FAILURES

The Remote Terminal data reception of Invalid Command Word and Invalid Data Receptions shall be handled as per the 1553B standard.

SECTION F10
PHYSICAL LEVEL

The physical interface between the SSCs and the IRs for each service shall be as defined in paragraphs of HE - 06 - 2 listed below.

IR HWCI	SSC HWCI	HE—06—2 Section
SSA EQUIPMENT	SSA CONTROL	23, 27, 36
MA RCVR/XMIT	MA CONTROL	23, 27, 36
KSA LOW DATA RATE	KSA CONTROL	23, 27, 36